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# **Chesapeake Bay Water-Column Hypoxia Monitoring End-of-Year Data Report 2024**

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# Summary

In 2024, the NOAA Chesapeake Bay Office (NCBO) successfully completed its second full season of deploying buoy-based hypoxia monitoring stations across Chesapeake Bay. These stations continuously collected crucial water-quality data throughout the water column from April to December. The effort expanded monitoring of hypoxic conditions in the Potomac and Choptank rivers. Tracking real-time, seasonal water column data on dissolved oxygen (DO), conductivity, and temperature is key to understanding system dynamics. The NCBO field team dedicated 37 days of on-water operations, implementing lessons learned from the previous year to enhance data reliability and streamline maintenance and buoy recovery procedures.

Data reliability improved notably in 2024. A review of the data shows that, in many cases, 90% of the data collected at each station has a high level of confidence, making it suitable for evidence-based management decisions. This improvement is primarily due to the implementation of lessons learned from previous seasons, refined data collection methodologies, and a robust inventory of replacement sensors. Although anticipated challenges, such as inclement weather and vessel breakdowns, did occur, NCBO staff worked diligently to maintain a consistent maintenance schedule.

The project adhered to rigorous quality assurance and quality-control (QA/QC) measures, consistent with regional partners' practices and adhering to an Environmental Protection Agency-approved [Quality Assurance Project Plan \(QAPP\)](#) (Ruehrmund et al., 2023a). Innovative data management techniques were implemented to efficiently process and visualize the collected data, ensuring its suitability for a wide range of analyses. This report details the standards, policies, and procedures used for field asset management and data characterization and includes comprehensive graphs and plots illustrating data quality from all six hypoxia buoys deployed in 2024.

Consistent with 2023, data reveals a noteworthy connection between data quality and the frequency with which maintenance could be conducted. The most reliable data came from the three buoys located on the Choptank River, which were the most protected from wind and waves, making them the most accessible. There were also challenges in determining the accuracy of data that included swings in DO levels in excess of 6 mg/L within a few hours or where levels of DO remained less than 0.1 mg/L for days. Additional hurdles occurred from not having direct access to data in part due to buoys deployed in areas with poor cellular service.

# 1. Project Background

Water-quality impairment in the Chesapeake Bay is primarily driven by Bay stratification and excessive long-term nutrient input from runoff and groundwater (Murphy et al., 2011). It manifests as seasonal hypoxia, particularly in the deeper mainstem (though it can occur elsewhere) (Bever et al., 2018). This hypoxia, with its detrimental effects on aquatic life, serves as an integrated indicator of watershed-wide nutrient pollution. Therefore, comprehensively monitoring the vertical and horizontal extent, as well as the duration, of hypoxic zones is essential for accurately assessing the health of the Chesapeake Bay. This in turn can help improve forecast models and track the progress of restoration efforts.

While the Chesapeake Bay Program's existing water-quality monitoring network offers broad spatial and temporal coverage, with monthly or bimonthly sampling at fixed stations spaced several kilometers apart, it lacks the high-resolution temporal data needed for a complete understanding of hypoxia dynamics. Specifically, there is a recognized need for continuous, real-time, vertically sampled profiles of DO to adequately assess short-duration water-quality criteria (weekly, daily, hourly and instantaneous), which can be crucial for protecting sensitive species. Historically, obtaining such data has been challenging, but recent advancements in both hypoxia modeling and sensor technology are making this level of monitoring feasible.

Building on these technological advancements, Scavia et al. (2021) further emphasized the importance of advanced ecological forecasting techniques for effectively understanding and managing complex ecosystems like the Chesapeake Bay. Their research, using a Chesapeake Bay estuarine hypoxia model as a case study, highlighted the benefits of focusing on predictive accuracy, robust uncertainty characterization, and direct relevance to management decisions. They found that employing appropriate forecast metrics, such as average summer or total annual hypoxia (which proved more predictable than monthly metrics), and incorporating multiple data sources (which allows for the separation and quantification of different uncertainty components, including measurement error) significantly improves the accuracy and reliability of ecological forecasts.

In response to the identified need for more detailed hypoxia monitoring by the Chesapeake Bay Program, and leveraging the capabilities highlighted by Murphy et al. (2011), Bever et al. (2018), and Scavia et al. (2021), efforts have been undertaken to deploy vertical arrays equipped with sensors for real-time data transmission of DO levels and other key parameters. These deployments aim to efficiently and sustainably provide the necessary DO data for enhanced monitoring of Chesapeake Bay hypoxia. Following a successful pilot project conducted during the summer of 2019, two additional pilot deployments were carried out in December 2021 and summer 2022. The insights gained from these initial tests paved the way for the first comprehensive deployment, which involved three individual buoy systems operating from April to December 2023 (Ruehrmund et al., 2023b). This effort was expanded in 2024 to include a six-buoy system, with three buoys deployed in the Choptank River and three in the Potomac River, further enhancing the real-time monitoring capabilities for this critical environmental challenge.

Water-quality data produced by this project will be used to define water column habitat, including seasonal hypoxia, salinity, and temperature conditions necessary to support living resource management decision making (Chesapeake Bay Program, 2025). The information will also be used to develop and assess water-quality criteria standards with the goal of restoring regulatory segments of water in the Bay and its tidal rivers toward their attainment goals.

Water-quality data is required to support refinement, calibration, and validation of the Chesapeake Bay eutrophication and watershed models. In essence, this data establishes the foundation for ongoing work to enhance water-quality

monitoring in Chesapeake Bay, underscoring the significance of addressing technical challenges for more precise and sustainable data collection.

Since the inaugural pilot launch of this innovative hypoxia monitoring project, the associated fieldwork has become a valuable educational opportunity, extending its effect beyond purely scientific data collection. A key component of this educational outreach has been the active participation of college students as interns. These internships provide hands-on experience in all aspects of the project, from instrument deployment and maintenance to data collection, processing, and analysis. Students gain practical skills in oceanographic fieldwork, learn about the complexities of estuarine ecosystems, and contribute directly to a real-world environmental monitoring effort. This immersive experience is invaluable for students pursuing careers in environmental science, oceanography, or related fields, bridging the gap between theoretical knowledge and practical application.

Furthermore, the project has prioritized data transparency and accessibility, recognizing the importance of sharing scientific findings with the broader community. The 2023 quality controlled data collected by the buoy system is publicly available, allowing researchers, educators, and the general public to access and utilize this valuable information (see <https://buoybay.noaa.gov/data/2023-water-column-data>). Near real-time raw data is accessible through the U.S. IOOS Environmental Sensor Map portal (see Section 4.5). This open-data policy has promoted the integration of real-world data into college coursework by professors at various institutions. Instructors are using Chesapeake Bay hypoxia data to develop engaging and relevant learning experiences for their students, allowing them to work with actual environmental data, analyze trends, and draw their own conclusions. This integration of real data into the curriculum not only enhances the educational experience for the upcoming generation of researchers and environmental scientists, exposing them to the challenges and rewards of working with real-world datasets, but also fosters a deeper understanding of the Chesapeake Bay ecosystem and the importance of environmental monitoring and management.

This report documents the standards, policies, and procedures used by the NOAA Chesapeake Bay Office's (NCBO) activities related to the project's fourth year. It discusses lessons learned and justifications for actions not outlined in the Quality Assurance Protection Plan (QAPP) submitted to the Environmental Protection Agency (EPA). Serving as a comprehensive guide, this document aids NCBO and its partners that are engaged in continuous water-quality monitoring activities. It also serves as a valuable resource for identifying memoranda, publications such as the QAPP and Maryland Department of Natural Resources (MD-DNR) Chesapeake Bay Hypoxia Report, and other relevant literature that offers detailed insights into techniques and requirements. Moreover, this document provides recommendations for the 2025 deployment and helps the user of data understand its significance and impact.

Lastly, these policies and procedures supplement NCBO's existing QA/QC plans for real-time water-quality data collection in the Bay. The report also defines data-quality classifications—"good" (acceptable), "suspect" (questionable), and "bad" (unusable)—along with the rationale for each classification. This information is essential for evaluating the quality of collected data and its suitability for understanding hypoxic conditions in the Chesapeake Bay. While this report provides guidance on data quality, the ultimate decision regarding data usability for policy-related decisions rests with the individual data user.

## 2. Project Description

### 2.1 Station Locations

From March 2024 to December 2024, NCBO deployed six vertical arrays of sensors to monitor water-quality conditions, with a focus on hypoxia, in the Chesapeake Bay (Map 1). Their locations were:

Choptank Stations

- The Sharps Island station (CB4MH\_01) 38.61936° N / -76.40956° W
- The Chlora Point station (CHOMH2\_01) 38.63505° N / -76.14605° W
- The Lower Choptank station (CHOMH1\_01) 38.629° N / -76.319°W

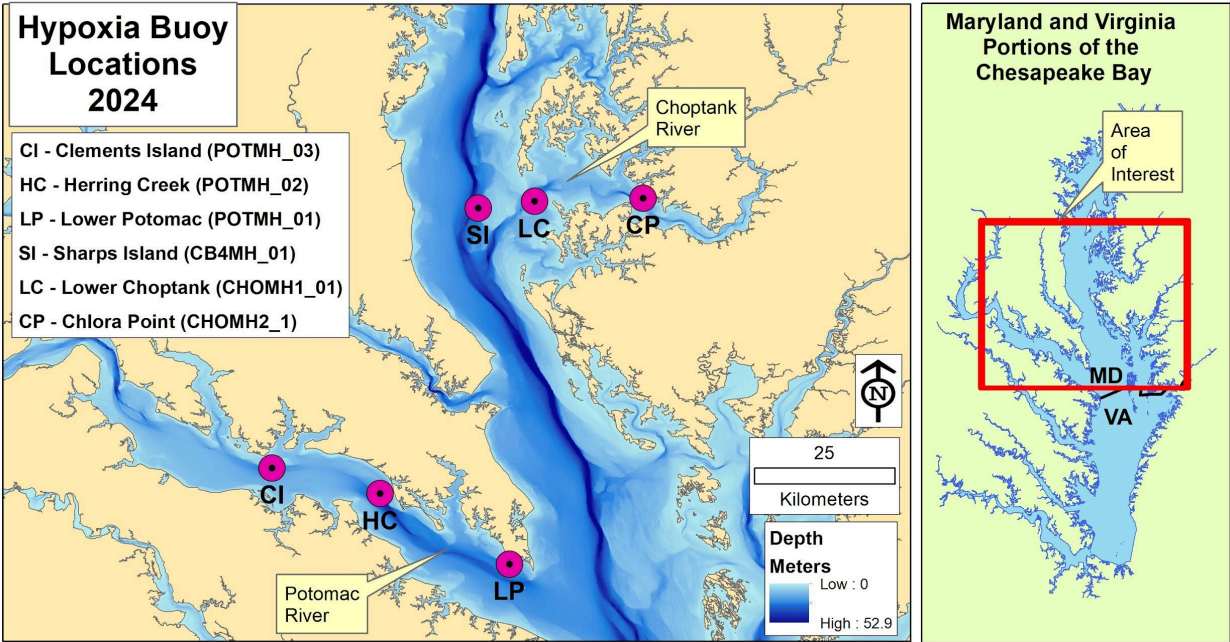
Potomac Stations

- The Lower Potomac station (POTMH\_01) 38.049° N / -76.359° W
- The Herring Creek station (POTMH\_02) 38.1615°N / -76.567°W
- The St Clements Island station (POTMH\_03) 38.2026° N / -76.74° W

The stations were located near historic long-term Chesapeake Bay Program water-quality monitoring stations. Station duration deployments are defined as periods where at least one sensor on the array was collecting reliable DO data or at the end of 2024 (Table 1).

Station	2024 Data Collection Duration
CB4MH_01	May 8 to August 5
	August 13 to November 13
CHOMH2_01	April 9 to November 13
CHOMH1_01	January 1 to February 24
POTMH_01	April 23 to December 31
	June 11 to July 24
	August 7 to November 26
POTMH_02	June 25 to October 11
POTMH_03	November 7 to December 4
	June 11 to December 17

Table 1. Timeline of hypoxia station deployments where a station had at least one working DO sensor.



Map 1. 2024 hypoxia buoy stations. Three stations were located in the Choptank River; three in the Potomac River.

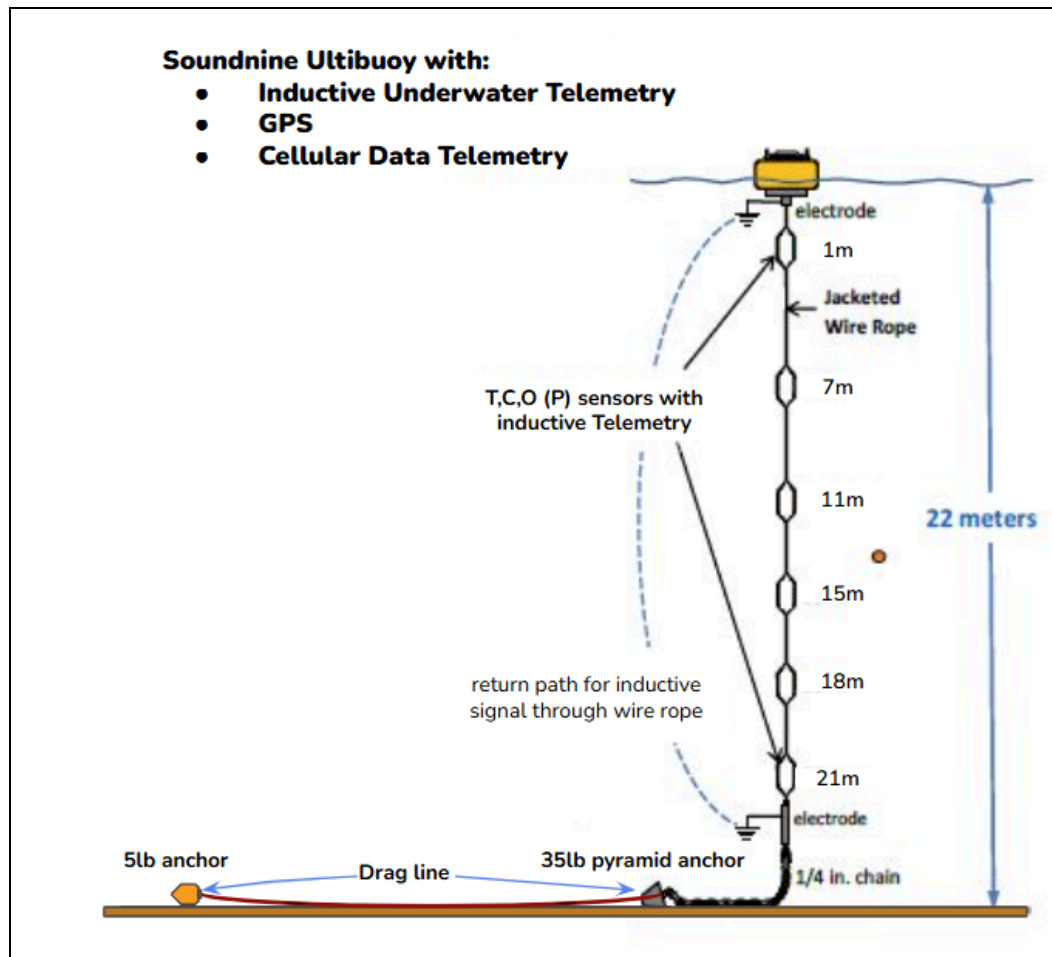
## 2.2. Station Design

All stations were designed to comprise a UB45-IM buoy, inductive cable, mooring system, and a drag line. The surface buoy was a Soundnine UBC-ISC Ulti-Buoy, which contained a cellular modem, GPS, inductive magnet, an integrated solar panel and batteries. The inductive cable ran from the bottom of the buoy to the mooring system. In addition, a drag line was attached to the mooring system for the purpose of retrieving the buoy. Each station was equipped with a single fish telemetry receiver and three to six XIM-CTP-DO data sondes, which collected pressure, conductivity, temperature, and DO (Figure 1). XIM-CTP-DO sensors were organized along the cable at various depths depending on the station's total depth. For example, all stations had a sensor located at 2m, 5m, and 8m in the water column; However, there were variations in sensor placement beyond 8m depending on the specific station depth. Table 2 shows sensor placements among each station.

Station 2024	Sensor Placements
CHOMH2_01	2m, 5m, 8m
CHOMH1_01	1m (Jan-Feb), 2m, 5m, 8m
CB4MH_01	2m, 5m, 8m, 11m, 13m, 15m
POTMH_03	2m, 5m, 8m, 11m, 14m
POTMH_02	2m, 5m, 8m, 11m, 14m
POTMH_01	2m, 5m, 8m, 10m

Table 2. XIM-CTP-DO data sondes' designed location on each station's inductive cable.



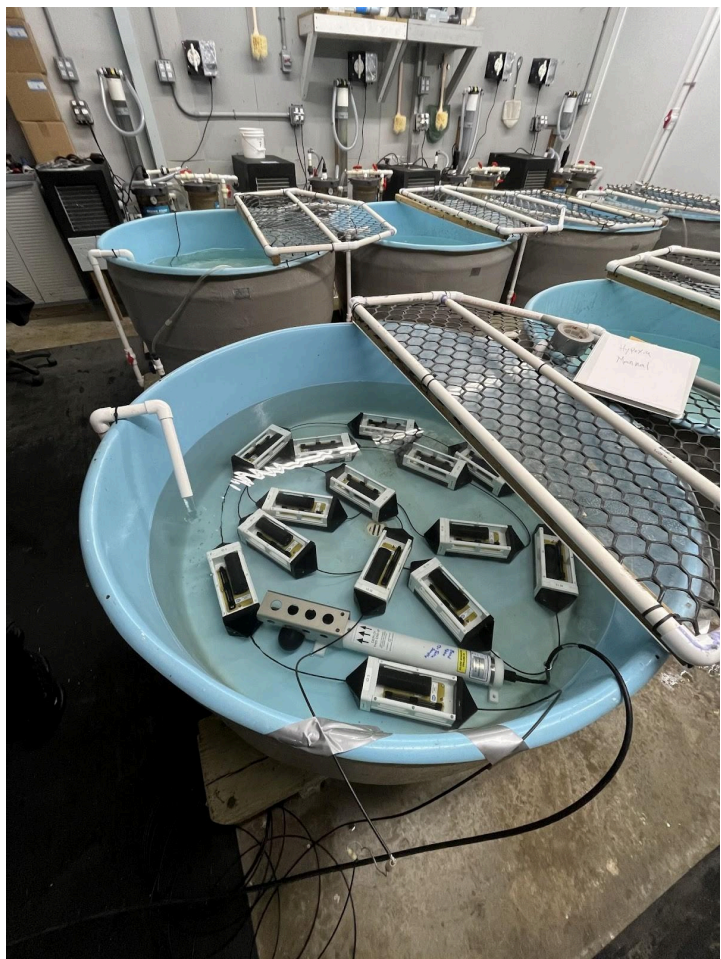


*Figure 1: Hypoxia buoy system schematic diagram showing the layout of a system in the water column. The diagram shows an example of the sensor's distribution along the cable, measuring parameters in the water column. Parameters consist of pressure (db), conductivity (S/m), temperature (°C), and DO concentration (mg/L).*

## 2.3. Lab Validation Work

### Oxford Sensor Validation Laboratory

All new factory-calibrated sensors and sensors from the field that report suspect or bad data are validated at the Oxford Cooperative Laboratory in Oxford, Maryland. After fouled instruments are cleaned (outlined in section 3.2), sensors are placed in 150-gallon tanks to begin the validation process (Images 1 and 2). Each tank is filled with filtered water from the Choptank River or with municipal water from the Town of Oxford, Maryland. Tank water conditions are then manipulated to reflect relevant water-quality conditions similar to those observed in the Chesapeake Bay for sensor accuracy validation.



*Images 1 and 2: 2024 tank configurations in the Oxford Laboratory for the validation of sensors.*

New hypoxia instruments arrive with factory-calibrated coefficients. At the factory, DO is calibrated at 100% saturation, while conductivity uses a multi-point calibration ranging from ocean to estuary conditions. Calibrations are finalized by comparing all instruments against each other. Upon delivery, NOAA’s validation lab ensures their accuracy, functionality, and compatibility with NCBO’s information technology systems.

Tank water conditions were set up as described in Table 3. These conditions are designed to test whether sensors are within accuracy specifications under typical Chesapeake Bay conditions. If specifications are not met, sensors may be returned for factory recalibration or have values adjusted by corrections to raw data (if corrections can be adequately accomplished by linear corrections). Tank values are targets to cover the typical range of values in the Chesapeake Bay; they need not be exact, but should be stable during the test period. Any of the tanks can be aerated to DO saturation (generally about 103%).

	Tank 1	Tank 2
Temp (C)	10	19
Dissolved Oxygen (mg/L)	10	7
Conductance (S/m)	0.5	2.5
DO Saturation	Air Saturated	Ambient

Table 3: 2024 tank configurations in the Oxford Laboratory for the validation of sensors.

Hypoxia sensors are placed in validation tanks next to a factory-calibrated SeaBird SBE37 microCAT CTD-DO as a side-by-side comparison. Sensors acclimate for 30 minutes in validation tanks that reflect DO, salinity, and temperature levels observed in the Chesapeake Bay. Hypoxia sensors are validated within a <3% tolerance against a factory-calibrated SeaBird microCAT CTD-DO. SeaBird instruments are calibrated yearly by the manufacturer; this process is documented. Service and calibration methods performed by SeaBird Scientific can be found at <https://www.seabird.com/service-calibration-information>.

All calibration documentation is stored on a cloud-based server and can be accessed upon request. Additional descriptions can be found in the Water-Column Hypoxia Monitoring Quality Assurance Project Plan (QAPP) (Ruehrmund et al., 2023a).



## 3. On-the-Water Operations

### 3.1 Challenges with Long-Term Monitoring

Hypoxia buoys are designed to collect and transmit data on temperature, conductivity, DO, and pressure over extended periods. However, their prolonged deployment—especially in biologically rich environments—presents significant challenges that can lead to data-quality issues. A primary concern is biofouling: the accumulation of algae, barnacles, and other marine organisms on the buoy's sensors and mechanical components. This growth can compromise data accuracy, obstruct sensor functionality, and even lead to mechanical breakdowns. The 2024 field season exemplified these challenges. Biofouling remained a substantial issue, particularly during the warmer months (June to September), and was exacerbated by the expansion of monitoring efforts further upriver to less-saline environments. Marine growth composition varied with distance from the Chesapeake Bay mainstem. Less-saline, upriver areas exhibited predominantly algal growth (Images 3 and 4), while higher-salinity areas closer to the mainstem saw increased sediment accumulation and a greater presence of marine macroinvertebrates and barnacles (Image 5). Interestingly, deeper sensors, likely due to lower light penetration and cooler temperatures, exhibited comparatively little biofouling or were subjected to near 0.0 mg/L of DO. Similar to previous years, growth of organisms did not equally skew data. DO and temperature data showed remarkable resistance to marine growth when regular maintenance could not be conducted. However, the conductance cells were susceptible to cracking and to having small organisms grow inside the glass that were challenging to remove once established.



*Images 3, 4, and 5: Types of biofouling observed throughout the season. Images on the left and middle show various algae growth while the image on the right side shows barnacles growing on the sensor.*

Previously, aside from travel, cleaning buoys and sensors was the most time-consuming aspect of fieldwork. To address the increased amount of fieldwork, a small, low-power pressure washer (1,350 psi) was incorporated to remove debris from the exterior of the sensors and buoys, taking care to avoid direct contact with the delicate sensor elements. For

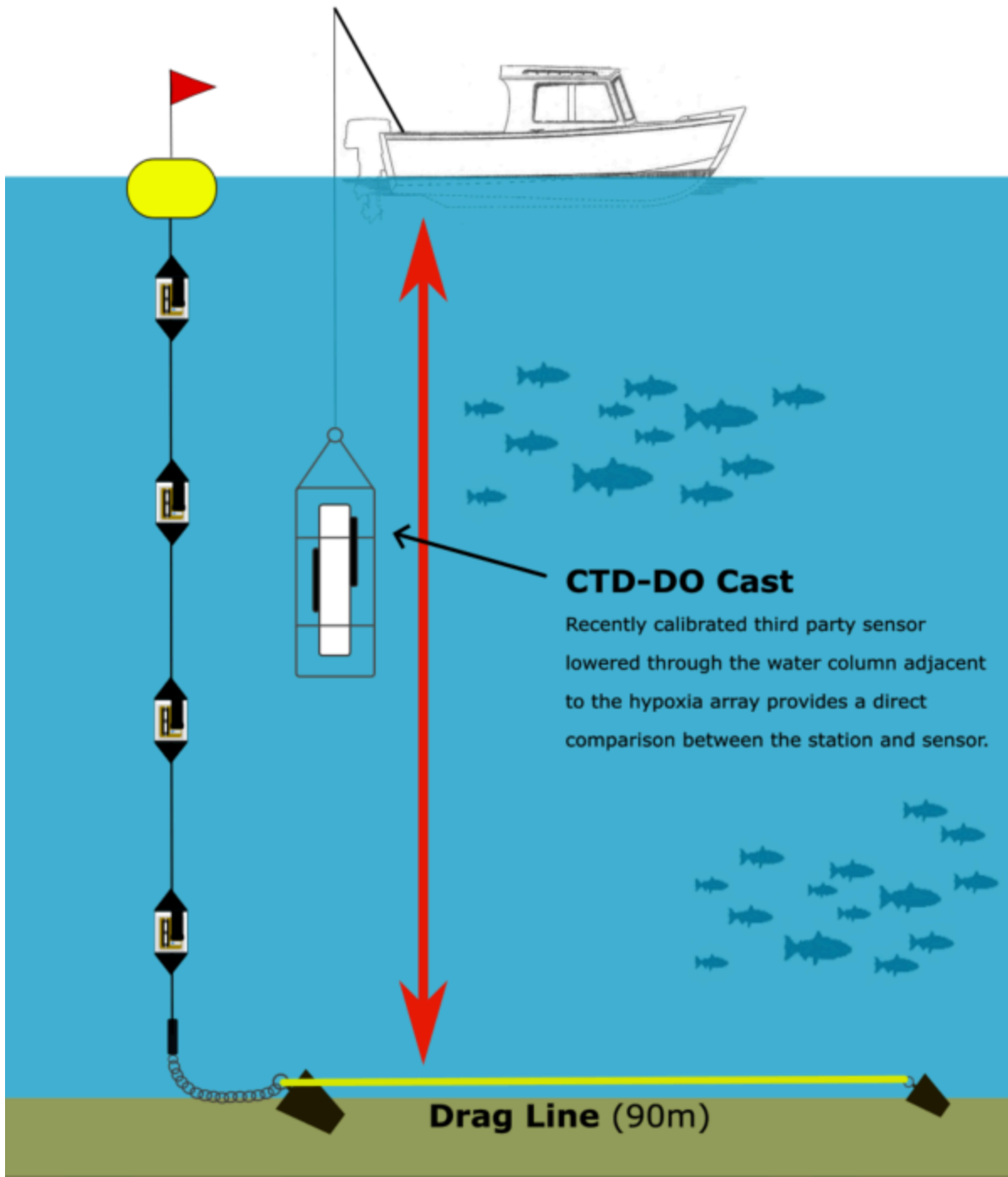
sensors with extensive biofouling, especially within the conductance cell, a swap-out procedure was adopted: heavily fouled sensors were exchanged for clean replacements in the field, allowing the fouled sensors to be thoroughly cleaned onshore. While the pressure washer proved useful, even cautious application potentially damaged the DO sensors. On a few occasions, DO sensors ceased functioning for unknown reasons, and subsequent manufacturer examination revealed water intrusion into the sensors' internal components. It remains unclear whether these failures were caused by the pressure washer or preexisting sensor defects.

The maintenance schedule, dictating the frequency of site visits, was revised from the 2023 schedule. The geographic distribution of stations in the Potomac and Choptank rivers made weekly visits to all sites within the same week logistically challenging. In 2023, with fewer stations and a smaller sensor inventory (limiting the number of replacements for heavily biofouled sensors), weekly visits were feasible and required to keep biofouling to a minimum. Analysis of the 2023 data also indicated that sensors could reliably operate for up to two weeks without significant performance degradation. Consequently, for the 2024 season, stations were visited on a biweekly cycle, as the increased sensor inventory provided enough replacements for those requiring cleaning due to extensive biofouling. Furthermore, this change in visit frequency, along with the increased travel time required for the Potomac River sites, required the positioning of a vessel on the Potomac River to allow a greater ease of access to the buoys and reduce time on the water traversing the Bay.

Weather conditions, particularly during the fall months, again proved to be unpredictable and occasionally severe, mirroring the challenges faced in the previous year. These periods of poor weather sometimes disrupted the planned maintenance schedule and required flexibility in prioritizing site visits. Despite these environmental hurdles, the project benefited from increased resources, including additional equipment, staff, interns, and support from Chesapeake Conservation and Climate Corps and NOAA Corps personnel.

### **3.2 Field Visits**

Site maintenance visits typically alternated weekly between the three Choptank and three Potomac sites. NCBO's R/V *Potomac* and R/V *Bay Commitment* were used for the 2024 field season, with the *Potomac* used primarily in the Potomac and the *Bay Commitment* primarily used in the Choptank. When visiting a hypoxia buoy, a conductivity, temperature, depth, and DO (CTD-DO) vertical cast was performed before buoy removal (Figure 2). A recently calibrated SeaBird SB19 CTD-DO was used to profile the water column with the use of an A-frame and winch to maintain a constant drop velocity (Images 6 and 7). To aid in sensor recovery, a static line, approximately 100 yards long with a weight at the end, was attached to each buoy mooring upon deployment. This "drag line" allowed for bottom-up sensor retrieval, which reduces stress on the inductive cable compared to top-down recovery. Recovery involved using a grappling hook attached to a rope to snag the drag line, and an A-frame equipped with an electric motor to haul in the line and mooring. Once the mooring was alongside the vessel, the sensors were then manually retrieved from the water.



*Figure 2. CTD-DO cast adjacent to hypoxia sensor array.*

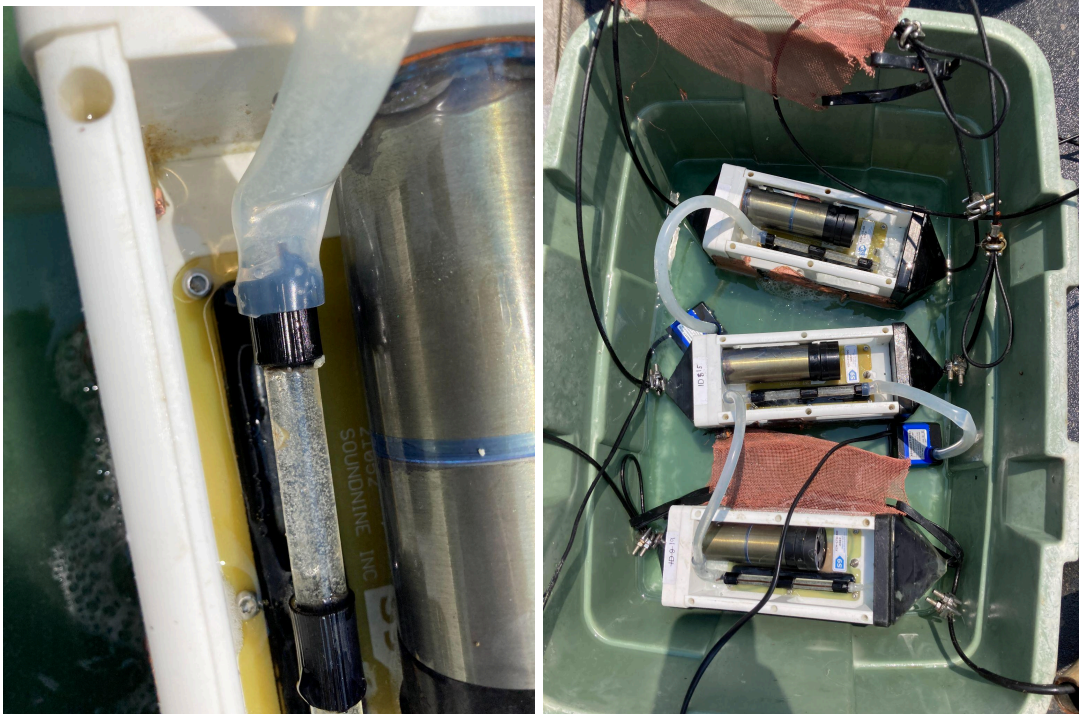




*Images 6 and 7: CTD-DO being lowered into the water upon station arrival (left). Recently calibrated CTD-DO (right).*

Once all sensors were on deck, copper screens and mesh were removed, and the condition of each sensor was documented with pictures. Sensors were then cleaned: A pressure washer was carefully used to remove the buildup of organic material from each sensor, and if barnacle growth was present, sensors were placed in a tub of mildly acidic solution for 10 minutes. While in the tub, medical tubing attached to small pumps were used to circulate the solution through conductance cells (Images 8 and 9). Following sensor cleaning, non-functional or compromised sensors were replaced with calibrated, operational units. Copper mesh was affixed to the conductance cell of each sensor, and a copper screen was secured to the sensor's frontal surface using zip ties to mitigate biofouling within the sensor cells. After all sensors were equipped with the protective mesh and screen, the sensor array was redeployed. This involved lowering the mooring and sensor array alongside the prepositioned drag line. Upon redeployment, the direction of the drag line was recorded. A 10-minute equilibration period was observed to allow the sensors to acclimate to the ambient water conditions, after which a second CTD-DO cast was conducted. These CTD-DO casts were integral to maintaining quality assurance throughout the field season. Further procedural details are outlined in the NOAA Quality Assurance Project Plan (QAPP) (Ruehrmund, et al. 2023a).





*Images 8 and 9. Medical tubing attached over conductance cell to allow acidic solution to circulate through (left). Sensors sitting in a tub with pumps circulating the acidic solution through conductance cells (right).*

After the 2024 season, the number of days each buoy was in the water for, as well as, the average number of days between each station visit were calculated (Table 4). On average, buoys were visited for maintenance every 13 to 14 days, which met the planned goal of visiting each station utmost every two weeks. The average number of days between maintenance visits in 2024 was similar to the number of days calculated in the 2023 season (Table 5). On average, buoys located in the Potomac River were in the water for 173 days, while buoys in the Choptank River were in the water for approximately 200 days (except CHOM1/CHOMA, which was in the water since the beginning of January).

Station	Total days buoy in water	Average # number of days between visits	Average # of days between visits based on geographical location
CB4MH	182	12	14
CHOMH1/CHOMA	307	16	
CHOMH2	219	15	
POTMH1	168	13	13
POTMH2	163	12	
POTMH3	189	16	

*Table 4. A table describing the comparison between scheduled station visits from the 2024 season.*

	Station	Total days buoy in water	Average # number of days between visits
2023	Choptank	229	10
	Potomac	160	12
2024	Choptank	236	14
	Potomac	173	13

*Table 5. A table describing the comparison between scheduled station visits from the 2023 and 2024 season. The 2024 station visits are an average of the three stations located in the Choptank River (CB4MH, CHOMH1/CHOMA, CHOMH2) and Potomac River (POTMH1, POTMH2, POTMH3).*

### 3.3. Notable Actions

The following is a timeline of notable actions at each station during the 2024 season.

#### Lower Choptank CHOMH1/CHOMA

- 2/24/24 @ 1300 Buoy mooring broke likely due to corrosion, found off Taylor Island
- 4/23/24 @ 0910: Redeployed buoy with new sensors
- 6/3/24 @ 1202: Removed 8m sensor and swapped for a new one
- 6/3/24 @ 1302: Sensor depth adjusted
- 7/2/24 @ 1152: Removed and swapped 5m and 8m sensor
- 10/8/24 @ 1016: Removed and swapped 2m, 5m, and 8m sensor
- 11/14/24 @ 1006: Swapped telemetry receiver
- 12/10/24 @ 0943: Swapped cable and buoy, kept same controller and sensors
- 12/31/2024 @ 1259: End of 2024 data, buoy remained in the water

#### Sharps Island CB4MH

- 5/8/24 @ 1220: Deployed buoy
- 6/3/24 @ 1445: Sensor depth adjusted
- 6/20/24 @ 1026: Removed and swapped 11m sensor
- 7/2/24 @ 0945: Removed and swapped 13m sensor
- 7/16/24 @ 0800: Removed and swapped 8m sensor
- 8/5/24 @ 0933: Buoy recovered, cable cut due to being wrapped around boat propeller
- 8/13/24 @ 0938: Redeployed buoy
- 8/27/24 @ 0908: Removed and swapped 8m sensor
- 9/5/24 @ 0847: Removed and swapped 2m sensor
- 9/23/24 @ 1058: Removed and swapped 5m sensor
- 10/8/24 @ 1145: Removed and swapped 11m sensor
- 10/29/24 @ 0921: Removed and swapped 5m sensor
- 11/14/24 @ 0903: Recovered buoy for the season

#### Chlora Point CHOMH2

- 4/9/24 @ 1117: Deployed buoy
- 6/3/24 @ 1000: Removed and swapped all sensors (2m, 5m, and 8m)
- 6/3/24 @ 1106: Sensor depth adjusted
- 6/20/24 @ 1330: All sensors were very dirty after 17 days
- 9/10/24 @ 1219: Removed and swapped 2m and 5m sensor
- 11/14/24 @ 1128: Recovered buoy for the season

#### Lower Potomac POTMH1

- 6/11/24 @ 1038: Deployed buoy
- 7/24/24 @ 1054: Buoy moved 1150m NNW (from 38.0425066667°N, -76.35571667° W to 38.0503966667°N, -76.364193333°W); removed and swapped 2m and 5m sensor
- 7/29/24 @ 1130: Dragged slightly off station
- 8/7/24 @ 1027: Replaced buoy controller
- 11/7/24 @ 1035: Removed and swapped 5m and 10m sensor
- 11/26/24 @ 0600: Buoy mooring broke, drifted NW to 49646 Potomac River Dr., Scotland, MD 20687; recovered the same day
- 12/10/24 @ 1400: Attempted to drag for buoy mooring (38.05017955°N, -76.36393598°W)

#### Herring Creek POTMH2

- 6/11/24 @ 1139: Deployed buoy
- 8/7/24 @ 1207: Removed and swapped 11m and 14m sensor
- 8/20/24 @ 1135: Removed and swapped 2m and 14m sensor
- 9/5/24 @ 1130: Removed and swapped 5m and 14m sensor
- 9/24/24 @ 1240: Removed and swapped 8m sensor
- 10/3/24 @ 1129: Removed and swapped 14m sensor; moved 455 m south (from 38.1615°N, -76.567°W to 38.157°N, -76.568°W), new depth: 16.3m
- 10/11/24 @ 1240: Buoy mooring broke, drifted southeast toward Piney Point Lighthouse Museum & Historic Park; recovered the next day
- 10/23/24 @ 1100: Mooring line recovered (38.1612666667°N, -76.5681°W)
- 11/7/24 @ 0930: Redeployed buoy
- 12/17/24 @ 1132: Recovered buoy for the season

#### Clements Island POTMH3

- 6/11/24 @ 1229: Deployed buoy
- 8/7/24 @ 1430: Removed and swapped 2m sensor
- 8/20/24 @ 1033: Anchor moved 100m SE (38.0354166667 °N, -76.739178333°W)
- 9/24/24 @ 1445: Removed and swapped 11m sensor
- 12/17/24 @ 1230: Recovered buoy for the season

3.4. Maintenance Schedule

Table 6 summarizes field operations during the 2024 field season.

Legend	
Array Deployment	Array placed in water
Array Maintenance	Routine visit to clean array and conduct validation CTD-DO
Array Break Away	Array broke off mooring and recovered
Attempted Maintenance	Vessel maintenance prevented the recovery of array
Array Recovered	Array recovered and returned to shore
Buoy Recovered	Buoy Recovered and Returned to warehouse
No Visit	Array was not visited

Field Day	Date	POTMH1	POTMH2	POTMH3	CB4MH	CHOMH1/ CHOMA	CHOMH2
1	1/18/2024					Array Maintenance	
2	2/21/2024					Array Maintenance	
3	2/25/2024					Array Break Away	
4	4/9/2024						Array Deployment
5	4/23/2024					Array Deployment	
6	5/8/2024				Array Deployment	Array Maintenance	Array Maintenance
7	6/3/2024				Array Maintenance	Array Maintenance	Array Maintenance
8	6/5/2024				Array Maintenance		
9	6/11/2024	Array Deployment	Array Deployment	Array Deployment			
10	6/20/2024				Array	Array	Array

					Maintenance	Maintenance	Maintenance
11	6/25/2024	Array Maintenance	Array Maintenance	Array Maintenance			
12	7/2/2024				Array Maintenance	Array Maintenance	Array Maintenance
13	7/9/2024	Array Maintenance	Array Maintenance	Array Maintenance			
14	7/16/2024				Array Maintenance	Array Maintenance	Array Maintenance
15	7/24/2024	Array Maintenance	Array Maintenance	Array Maintenance			
16	7/29/2024	Array Maintenance					
17	7/31/2024				Attempted Maintenance	Attempted Maintenance	Attempted Maintenance
18	8/5/2024				Array Recovered	Array Maintenance	Array Maintenance
19	8/7/2024	Array Maintenance	Array Maintenance	Array Maintenance			
20	8/13/2024				Array Deployment	Array Maintenance	Array Maintenance
21	8/20/2024	Array Maintenance	Array Maintenance	Array Maintenance			
22	8/27/2024				Array Maintenance	Array Maintenance	Array Maintenance
23	9/5/2024	Array Maintenance	Array Maintenance	Array Maintenance			
24	9/10/2024				Array Maintenance	Array Maintenance	Array Maintenance
25	9/23/2024				Array Maintenance	Array Maintenance	Array Maintenance
26	9/24/2024	Array Maintenance	Array Maintenance	Array Maintenance			
27	10/3/2024	Array Maintenance	Array Maintenance	Array Maintenance			
28	10/8/2024				Array Maintenance	Array Maintenance	Array Maintenance
29	10/11/2024		Array Break Away				
30	10/12/2024		Buoy Recovered				

31	10/23/2024	Array Maintenance	Array Recovered	Array Maintenance			
32	10/29/2024				Array Maintenance	Array Maintenance	Array Maintenance
33	11/7/2024	Array Maintenance	Array Deployment	Array Maintenance			
34	11/14/2024				Array Recovered	Array Maintenance	Array Recovered
35	11/26/2024	Array Break Away/Buoy Recovered					
36	12/10/2024					Array Maintenance	
37	12/17/2024		Array Recovered	Array Recovered			
	<b>Total Station Visits</b>	13	14	12	15	19	15

*Table 6. Field maintenance was attempted once per week from April to December with the exception of station CHOMH1/CHOMA, which had been planned to be attempted once a month from January to April before breaking away in late February. Weather conditions, personnel availability, vessel mechanical breakdowns, and array break aways caused either delays or adjustments in projected weekly maintenance.*

Throughout the season, sensors were swapped or completely removed from a station for various reasons. Communication issues, extreme biofouling, or sensors producing abnormal readings would require a sensor to be switched for another sensor. Table 7 and Table 8 show the number of swaps that occurred during the season for each station and depth. The median number of times a sensor was swapped at a particular depth was 1 time. There were instances where sensors were swapped either 0, 2, or 3 times. Notably, one sensor at a specific depth required replacement four times throughout the monitoring season because it was generating anomalous data. It is hypothesized that sensors deployed at 14 meters depth at the Herring Creek station may have experienced interference from the benthic substrate or suspended particulate matter, owing to their close proximity to the seabed.

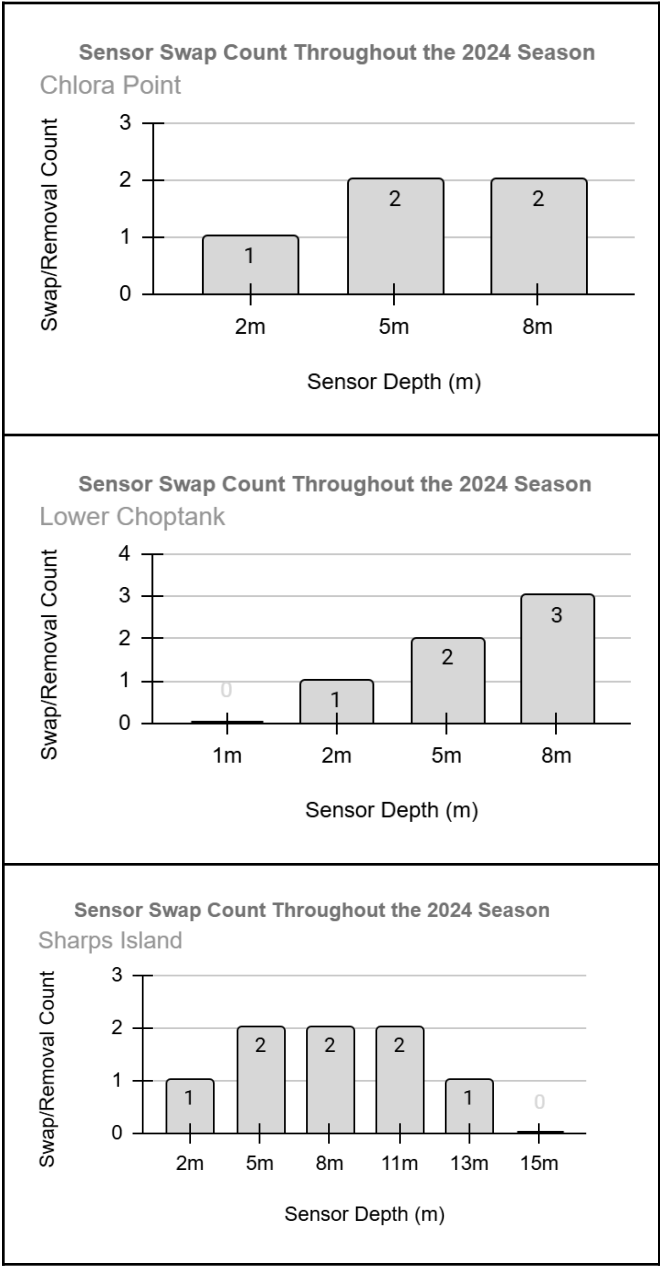


Table 7. Total sensor swap count among the Choptank River stations throughout the season.



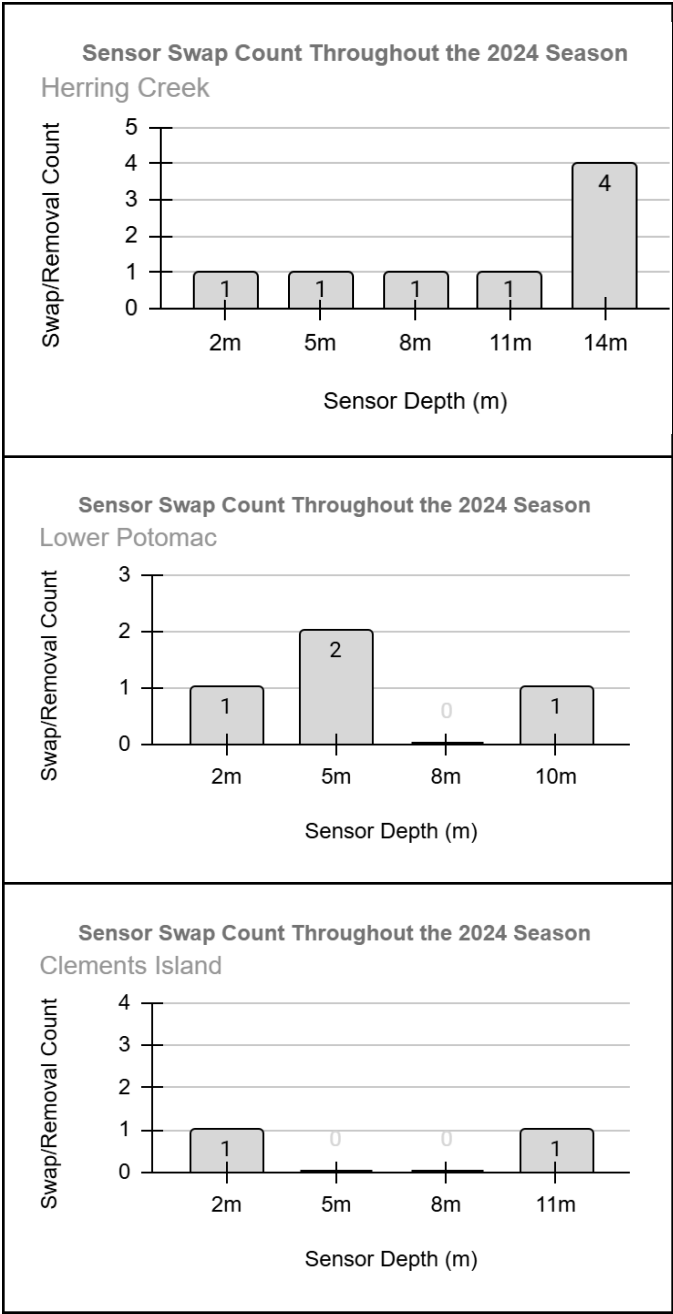


Table 8. Total sensor swap count among the Potomac River stations throughout the season.

### 3.5. Fieldwork Improvements and Recommendations

The 2024 field season saw improvements with how hypoxia arrays are managed, as well as an expansion of buoy stations. Stations were extended from three in 2023 (Lower Choptank, Lower Potomac, and Mid-Bay) to six total in 2024, with three in the Choptank River and three in the Potomac River (Map 1). In addition to an expansion of stations, field work methods were improved, increasing efficiency and equipment reliability.

#### Drag Line Recovery

A new recovery method was launched for the 2024 field season, utilizing a drag line instead of the previous retrieval system that used loops on the inductive cable. A semibuoyant drag line, approximately 100 yards long, was attached to the sensor array mooring and anchored to a second mooring on the bottom (Figure 2). Instead of winching the array up from the surface, the team used a grapple hook to retrieve the submerged drag line. This bottom-up recovery method reduced strain and wear on the inductive cable, which was found to be a point of failure. At the end of the season, an additional buoy was attached to the end of the dragline, decreasing the time to recover the buoy.

#### Database Access

NCBO gained additional database access in 2024. This provided several valuable functionalities, including the ability to address data gaps, modify internal sensor configurations, and access metadata such as cellular signal strength. This access also allowed for system alerts and the execution of certain diagnostic tests. However, direct access to the real-time data stream from the buoys remains a key limitation. Currently, the project depends on the manufacturer to backfill any data gaps and to resolve cellular communication issues. Independent access to the raw data stream would improve troubleshooting capabilities and reduce reliance on external support for routine data management.

#### Greater Availability of Spare Parts

In vast contrast to previous years, the 2024 season was marked by the availability of replacement sensors. More importantly, the available supply likely played a crucial role in increasing overall data reliability and contributing to improved QA/QC metrics. Having ample replacements on hand allowed for the exchange of sensors exhibiting signs of fouling or malfunction, minimizing downtime and ensuring continuous data collection. This contrasts sharply with prior years, where sensor availability was often a limiting factor, compromising data continuity and requiring more extensive post-processing to address gaps. In addition, custom modifications to the buoy construction further enhanced the robustness and reliability of the deployed hardware. Specifically, the addition of zinc anodes to the buoy hull provided cathodic protection, mitigating corrosion and extending the lifespan of the buoys themselves.

#### Future Cleaning Methods

Extended field durations, frequently exceeding 14 hours on the Potomac River visits, necessitate careful consideration of time management, particularly regarding sensor cleaning. The introduction of use of a low-power pressure washer in 2024 immensely reduced on-station cleaning time compared to the previous method of manual biofouling removal with a hand tool. However, concerns have been raised by the manufacturer regarding potential damage to sensor seals from pressure washer use, even at low power, possibly contributing to water intrusion and subsequent instrument failure. It should be noted that the instrument has no built in anti-biofouling capabilities. While the etiology of these failures (pressure washer versus preexisting defects) remains uncertain, the efficiency gains provided by the pressure washer

may justify its continued use, contingent upon the implementation of more stringent operational protocols to minimize risk. The established protocol of circulating Barnacle Buster through conductance cells will remain in place for internal biofouling removal.

To further streamline fieldwork and reduce on-site maintenance, a sensor exchange protocol has been proposed. While logistically viable, this strategy requires close coordination with NCBO's IT support to mitigate potential data gaps requiring subsequent manual correction at a later date. Removed sensors exhibiting heavy biofouling will be transported to the laboratory for cleaning via sonic agitation in a solution of water, bleach, and nonsurfactant soap.

## 4. Data Management

### 4.1. Quality Assurance and Quality Control

Accurate and reliable water-quality data are essential for effective environmental monitoring and ecosystem protection. For this project, NCBO integrated both automatic and manual data “flags” as part of the QA/QC protocols. Automatic flags, generated by algorithms applying IOOS QARTOD thresholds (discussed in section 4.4), detect anomalies and outliers in real time, quickly identifying potential problems like sensor malfunctions. Manual flags, applied by trained NCBO personnel, allow for review and validation of data, addressing complex situations that automated systems might miss. Additionally, manual flags override any automatic flags.

Specific details outlining quality-control policies can be found in the NOAA Quality Assurance Protection Plan (QAPP) (Ruehrmund et al. 2023a). As discussed above, a combination of manually applied and automatic data flags are used to evaluate water-quality data day to day. Flags are used to account for data that should not be used for seasonal assessments or that require additional investigation due to the conditions in which data was recorded. Manual flags are applied to data from physical actions taken by NOAA staff on the arrays that can include removing arrays from the water for maintenance or noting data from a CTD-DO validation cast that does not agree with data from arrays. Automatic flags are applied as data is recorded following the U.S. Integrated Ocean Observing System Program (IOOS) Quality Assurance/Quality Control of Real Time Oceanographic Data (QARTOD) procedures (Section 4.4).

### 4.2. Daily Review of Real-Time Data

Effective monitoring of the deployed buoys necessitates rigorous quality-control procedures, which include two daily inspections utilizing both the internal project dashboard and the IOOS website (Figure 3). The dashboard provides NOAA personnel with a centralized platform for evaluating key buoy parameters, encompassing geographic coordinates (latitude and longitude), battery status, water-quality data transmission, and internal temperature. Regular monitoring of these parameters is essential to ensure the continuous and reliable operation of the buoys. Figure 3 shows how data is collected in the field and processed into the annual report.

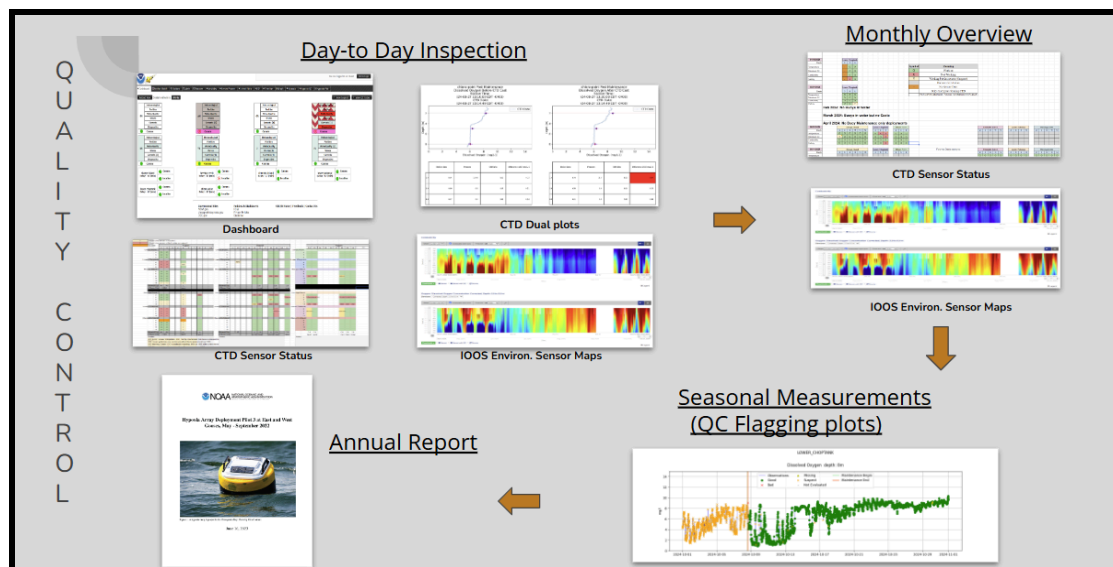


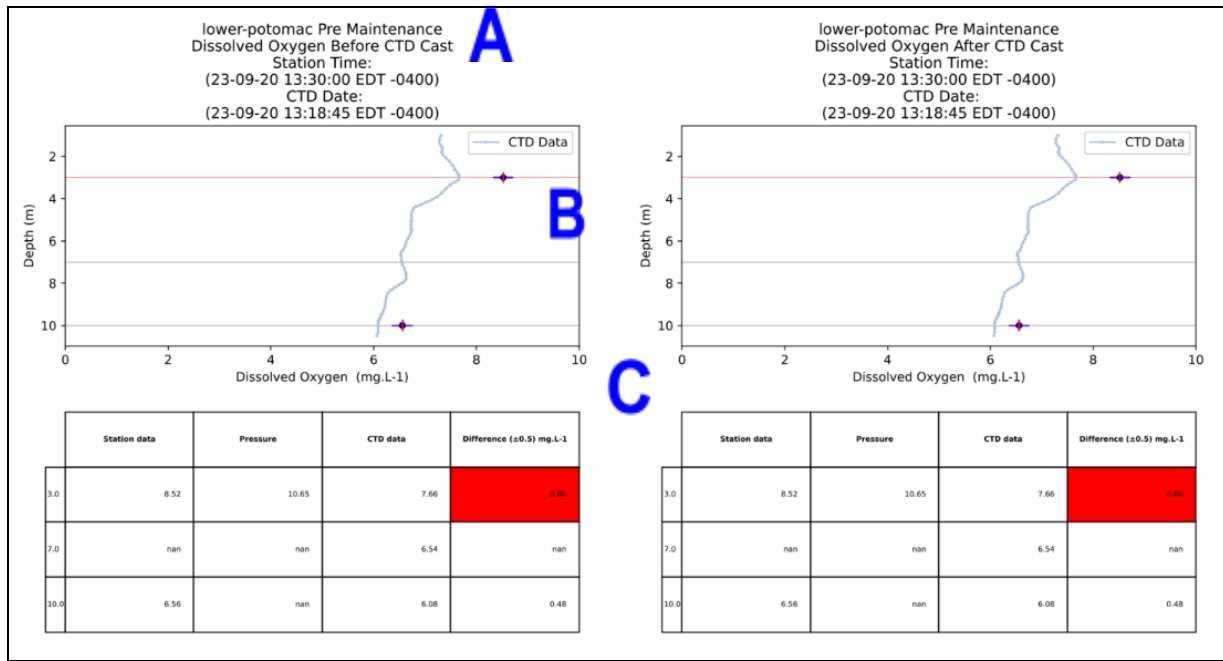
Figure 3: Summary of quality-control documents generated from maintenance visits.

### 4.3. Field Data: CTD Validation

Each maintenance trip includes a review of detailed field observations and generated CTD-DO validation plots. Field observations are documented and include general information about each station visit such as the date, time, station location, and weather conditions. Critically, these observations also record the CTD-DO cast time, buoy deployment and retrieval times, and any other relevant notes about actions taken during the visit (e.g., sensor removal, mooring damage). All components of these field observation notes contribute to the assessment of a sensor's data quality. These post-fieldwork observation documents are then used to generate CTD-DO validation plots (Figure 4). These line plots illustrate the difference between the buoy data and the corresponding CTD-DO cast data prior to array recovery (*pre-recovery*) and after array deployment (*post-deployment*). Four validation plots are created, from the pre and post, with array data displayed 10 minutes before and 10 minutes after the CTD-DO cast. There were instances where only a single CTD-DO cast was collected without retrieving the hypoxia buoy. The record of a sensor passing or failing a CTD-DO cast is recorded internally on a sensor status sheet (Figure 5), which tracks and documents the timeline of failing sensors.

In addition to trip-specific reviews, comprehensive yearly and monthly plots are generated, incorporating quality control (QC) flagging to provide a holistic overview of all QC assessments conducted throughout the monitoring season (Figure 6). These plots constitute a QC plot sensor summary, illustrating the performance of each sensor and the measured water parameters across both monthly and annual timescales. All plots and statistical charts are generated using the Pycharm Python platform. Each plot includes a detailed legend and informative subheadings to clearly delineate the displayed datasets. Subheadings specify the buoy station, measured water parameter, and sensor depth. The abscissa (x-axis) represents date and time, while the ordinate (y-axis) indicates the units of the measured water parameter. The legend provides a complete key to all identifying components within the plot. These comprehensive QC-assessed data plots are included in Sections 7 and 8 of this annual report, and a record of all manually applied flags, along with their associated justifications, is provided in the Appendices.

CTD Validation Sheet and Parameters



Key	Meaning
A	Information describing the station, parameter measured, date, and time of CTD-DO cast. The plots will either be Pre or Post maintenance. Pre is considered to be a CTD-DO cast prior to recovering the buoy for cleaning and inspection. Both plots will indicate Before/After CTD-DO cast
B	During a pre or post buoy cleaning CTD-DO cast, data 10 minutes before and after CTD-DO cast are recorded from the buoy to account for sensors acclimating to the water or variation in the water column. The purple mark on each graph represents a data point from a sensor at a designated depth at a given time.
C	The table shows the difference between the CTD-DO data and station data 10 before and after validation cast. A red box indicates data fell outside the acceptable thresholds. If a difference is observed between the station and CTD-DO data this is recorded as bad in the manual flag data sheet.

A total of 4 plots are developed after one station maintenance: Pre-recovery/before CTD-DO Cast, Pre-recovery/After CTD-DO Cast, Post-maintenance/Before CTD-DO Cast, Post-maintenance/After CTD-DO cast

Parameter	Value
Dissolved Oxygen	$\pm 0.5$ mg/L
Conductivity	$\pm 5\%$ of true value
Water Temperature	$\pm 0.2$ °C

Figure 4. Example of acceptable variation tolerances for hypoxia array based on thresholds as described in Michael et al., 2021.

CTD Sensor Status Sheet

Symbol	Meaning
O	Working
X	Not Working
Y	Working but inaccurate (Suspect)
	Did not visit station
-	No Sensor Data
	Only enter post cleaning CTD
	Pre Cleaning Datachecks Previous visit changing it to Suspect

09/24/24	Clements Island					Lower Potomac					Herring Creek				
Depth	2	5	8	11	14	2	5	8	10		2	5	8	11	14
Temperature	O	O	O	O	O	O	O	O	O		O	O	O	O	O
Dissolved O2	O	O	O	O	O	X	O	O	O		O	O	O	O	Y
Conductivity	O	O	O	O	O	O	O	O	O		O	O	O	O	O
Sailinty	X	O	X	O	X	X	O	O	O		O	O	O	X	O
10/3/24	Clements Island					Lower Potomac					Herring Creek				
Depth	2	5	8	11	14	2	5	8	10		2	5	8	11	14
Temperature	O	O	O	O	O	O	O	O	O		O	O	O	O	O
Dissolved O2	O	O	X	O	O	X	X	O	O		O	O	O	X	O
Conductivity	O	O	O	O	O	O	O	O	O		O	O	O	O	O
Sailinty	O	X	X	O	X	X	O	O	O		O	O	O	X	O

Figure 5: CTD Sensor Status Sheet is used as a review visualization of CTD-DO validation casts.



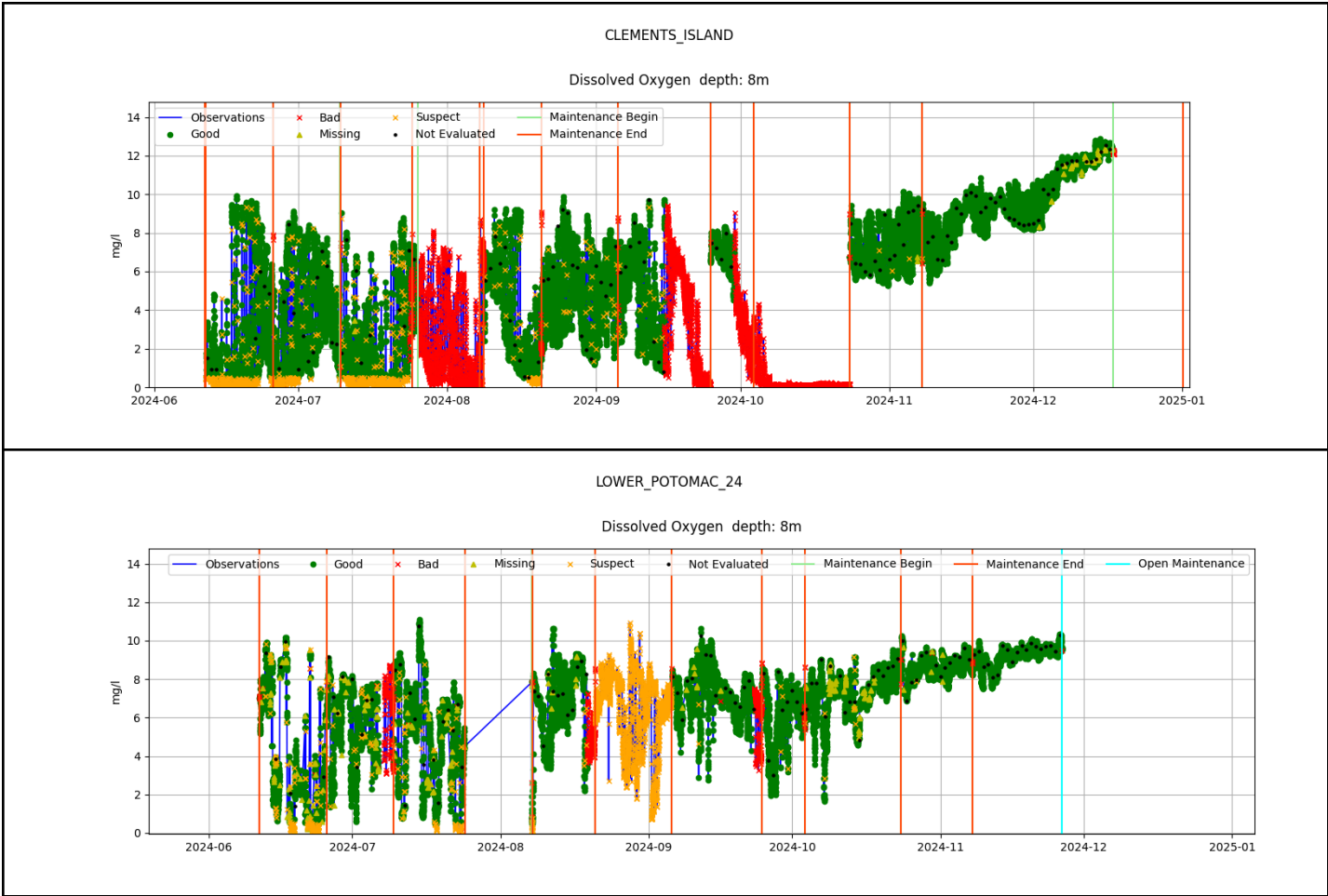


Figure 6: Yearly and monthly QA/QCed time series of data from hypoxia station.

4.4 QARTOD Tests

Automated, or automatic, flags are the first level of QA/QC used in the review of Quality Assurance/Quality Control of Real-Time Oceanographic Data (QARTOD); their QC codes are provided in Table 9. IOOS keeps the most up-to-date version record on their website: [https://ioos.github.io/ioos\\_qc/](https://ioos.github.io/ioos_qc/).

Automatic flag thresholds can be found in Table 10.

QC Codes	Value	Meaning
1	Good	Data fell within acceptable thresholds outlined in table 5
2	Not Evaluated, Not Available, Unknown	Data was not measured or no attempt was made
3	Questionable or Suspect	Data begins to raise doubts or concerns about their accuracy, reliability, or validity.
4	BAD	Data fell outside acceptable thresholds outlined in table 5
9	Missing	Data was not collected / received following the known interval of data transmission

Table 9. Definitions of flags applied to hypoxia data. QC codes are interpreted by python scripts in the database to categorize data.

## QARTOD Thresholds

	Water Temperature (Celsius)	Salinity (Practical Salinity Scale)	Dissolved Oxygen (Milligram per Liter)	Conductivity (Microsiemens Per Centimeter)	Sea Water Pressure (Decibar)
<b>Gross Range Test</b>					
suspect_span	(-2.0 °C, 35.0 °C)	(0.5 PSS, 30.0 PSS)	(0.5 mg/L, 15 mg/L)	(0.0 mS/cm, 46.0 mS/cm)	(0.5 dbar, 28.4.0 dbar)
fail_span	(-5.0 °C, 45.0 °C)	(0.002 PSS, 35.0 PSS)	(0 mg/L, 20 mg/L)	(0.0 mS/cm, 53.0 mS/cm)	(0.0 dbar, 30.0 dbar)
<b>Flat Line Test</b>					
tolerance	0.01 °C	0.001 PSS	0.005 mg/L	5.0E-4 mS/cm	0.001 dbar
suspect_threshold	2700 s	2700 s	2700 s	2700 s	2700 s
fail_threshold	3600 s	3600 s	3600 s	3600 s	3600 s
<b>Rate of Change Test</b>					
threshold	0.003 °C/s	0.0005 PSS/s	0.003 mg/L/s	0.002 mS/cm/s	7.0E-4 dbar/s
<b>Spike Test</b>					
suspect_threshold	2.0 °C	3.0 PSS	5 mg/L	1.0 mS/cm	0.5 dbar
fail_threshold	10.0 °C	6.0 PSS	10 mg/L	5.0 mS/cm	1.0 dbar

Table 10: Minimum parameter thresholds for data to pass QA/QC in IOOS. Note that conductivity (mS/cm) measurements are inherently temperature dependent and there is a prevailing standard of assuming a temperature of 25C/77F. Most salinity measurements in literature follow this convention.

## 4.5 Viewing Data in the U.S. Integrated Ocean Observing System Program (IOOS) Database

The Integrated Ocean Observing System (IOOS) provides a publicly accessible, online database containing continuous, real-time data, prior to formal quality control procedures. This platform enables users to graphically visualize and download data for user-defined periods, ranging from single-day intervals to multiple-month durations. Specifically, the IOOS platform utilizes "curtain plots," which employ a color gradient to represent the dynamic range of the measured parameters. Beneath these curtain plots, a bar chart provides a succinct visual representation of data quality metrics,

based on preliminary quality control assessments. For direct access to the individual IOOS pages for each monitoring station, links are provided below.

### Links to 2024 IOOS Station Pages

#### Choptank Stations

- The Sharps Island station ([CB4MH\\_01](#))
- The Chlora Point station ([CHOMH2\\_01](#))
- The Lower Choptank station ([CHOMH1\\_01](#))

#### Potomac Stations

- The Lower Potomac station ([POTMH\\_01](#))
- The Herring Creek station ([POTMH\\_02](#))
- The Clements Island station ([POTMH\\_03](#))

## 4.6 Data Flow

Moving water-quality data from the hypoxia buoys through the QA/QC process has a number of steps. Water-quality data is collected by a SoundNine Ulti-buoy controller. This uses SoundNine inductive modem technology to record data from sensors at various depths. Data is sent over the internet via a cellular transmission and processed on the SoundNine server before being sent to a NOAA relational database.

NCBO uses an “Extract, Transform, and Load” process to extract the data and store it in a Postgres database. This process is written in Java and runs on a schedule pulling the source database for changes. After loading data, a QARTOD process is run, applying the automated flags to the data. The flags are associated with each measurement, and the original source data is not modified. The QA/QC software is developed by IOOS and can be found at [https://ioos.github.io/ioos\\_qc](https://ioos.github.io/ioos_qc). The QC thresholds are set locally on the NCBO system and are auditable using a software version control system; these thresholds are described in Section 4.4.

Manual flags are applied for events such as sensor cleaning and erroneous sensor readings and are stored in the database. The manual and automated flags are combined into one final QARTOD status and can be rerun to update flags as needed.

The NCBO data can be accessed via REST API that exports data in a JSON format. NCBO also provides plots of the data that display QARTOD values.

Some definitions of the software terminologies:

- REST: <https://www.redhat.com/en/topics/api/what-is-a-rest-api>
- JSON: [https://www.w3schools.com/whatis/whatis\\_json.asp](https://www.w3schools.com/whatis/whatis_json.asp)
- ETL: <https://www.ibm.com/topics/etl>
- API: <https://www.ibm.com/topics/api>

## 5. Key Findings

### 5.1. Validating Data Challenges

#### Water-Column Variability

Data-quality assessment for this project adheres to the metrics defined by Michael et al. (2021), with specific emphasis on their established water-quality thresholds. A primary focus of this assessment is the correlation between data acquired from the deployed hypoxia arrays and independent CTD-DO casts. During data review, it is essential to acknowledge the inherent variability characteristic of dynamic coastal ecosystems, particularly under conditions of flood or ebb tides and elevated sea states.

The Chesapeake Bay's dynamic environment and the inherent variability within its water column contribute to fluctuations in water-quality parameters, including DO, across both short and long temporal scales. DO distribution is influenced by a complex interplay of factors including temperature, salinity, microbial activity, and atmospheric gas exchange. While water column stratification may occur, tidal exchange, seasonal variations, storm events, and wind-induced turbulence can induce mixing, resulting in the redistribution of DO throughout the water column.

Empirical observations have demonstrated that water column stratification can lead to rapid changes in *in situ* measurements, even in close proximity to the deployed hypoxia buoys. For instance, a temporal misalignment of only a few minutes between a measurement at a hypoxia station and a corresponding CTD-DO cast can result in measurement discrepancies due to rapidly evolving environmental conditions. Furthermore, sensors at each station require an equilibration period, often exceeding 10 minutes, following cleaning and deployment. This introduces additional complexity to the data validation process. Consequently, discrepancies in CTD-DO validation casts can arise, potentially leading to the erroneous validation failure of a station despite recent maintenance.

#### Expanding Manual Flags

The application of manual data-quality flags occasionally involves a degree of subjective judgment on the part of the reviewer. This inherent subjectivity can potentially introduce bias into the data, contrasting with the desired objectivity of information derived from direct observation and measurement. While it is plausible that more-experienced reviewers might apply more stringent, objective criteria due to their accumulated expertise, less-experienced reviewers may offer alternative perspectives on the data. To mitigate this potential for bias, NCBO staff participated in a calibration exercise prior to the end-of-season data review (Image 10). This practical training involved the review of specific scenarios where manual flags were applied, enabling staff to standardize their methodology and improve consistency in identifying and flagging erroneous data.

Reviewers were instructed to use all available resources, including field notes, photographic documentation, the internal dashboard, and CTD-DO plots, and were encouraged to seek clarification whenever any uncertainty arose. The review process focused on instances where CTD-DO casts failed QA/QC testing. Reviewers then determined whether a given parameter exhibited signs of failure prior to buoy retrieval ("pre-recovery") or continued to fail after redeployment ("post-deployment"), documenting justifications for the application of additional manual flags. All

applied flags were subsequently reviewed and received final approval from senior staff. While this document cannot encompass every possible scenario, the following examples illustrate the application of manual flags in specific situations (Images 11 to 16).

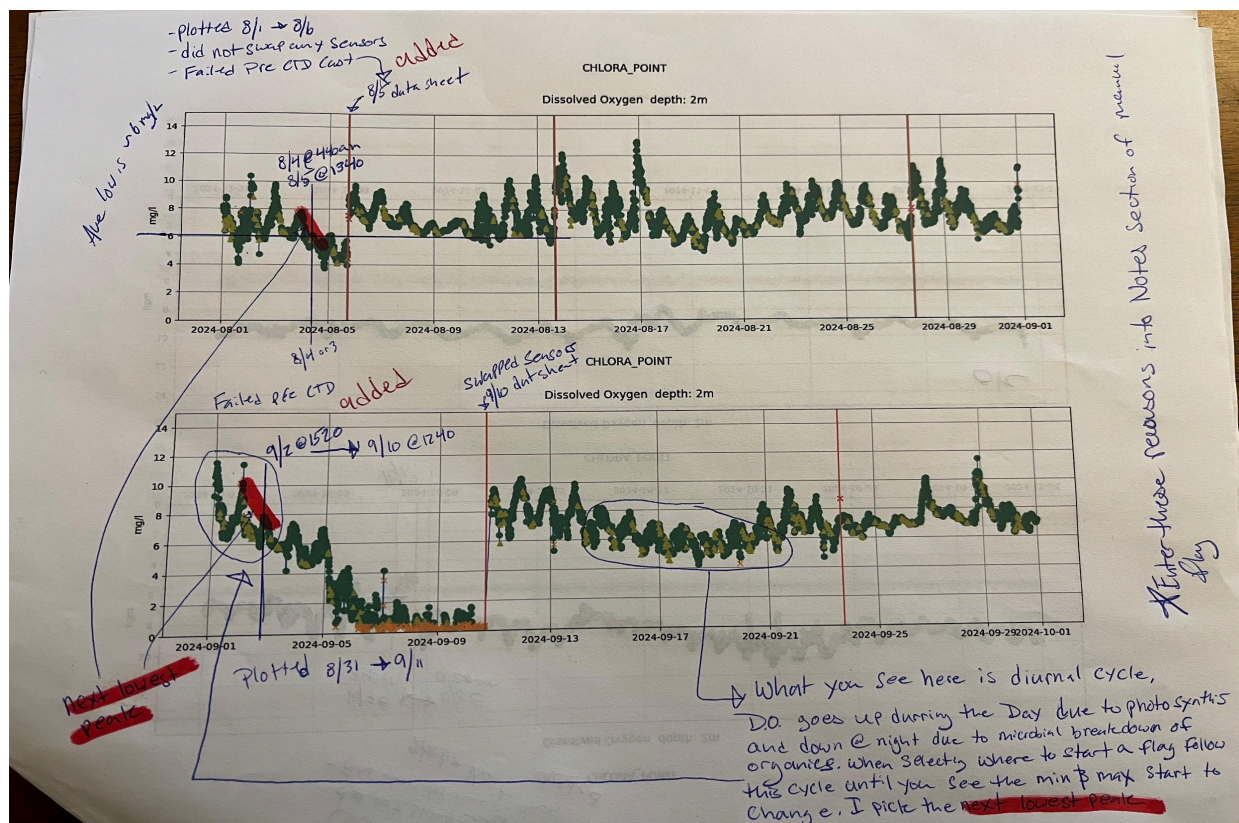


Image 10: Training material from NOAA staff on the justification for adding additional manual flags to the dataset.



## Other Examples

## Example 1

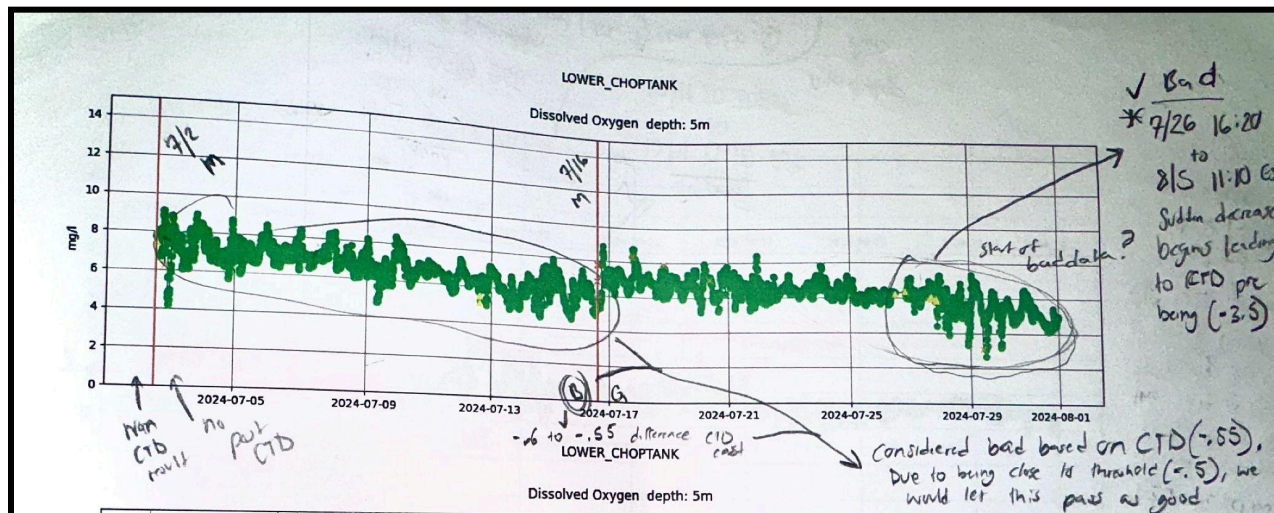


Image 11. A dissolved oxygen sensor at the Lower Choptank station was ruled to be good data until July 26, where the data begins to slowly decrease. After reviewing the pre-recovery-CTD-DOcast deployment data, data collected from July 26 to August 5 was overruled and considered bad data. The pre-recovery-CTD-DO-cast deployment had a difference of -3.5mg/L, indicating a measurement outside the standardized interval of whether the data status should be good.

## Example 2

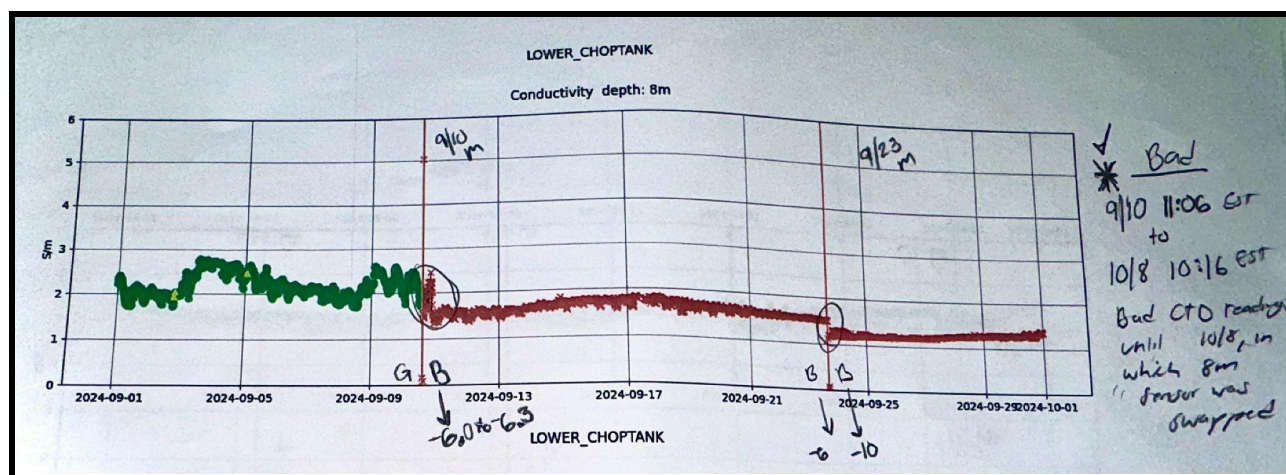


Image 12. A conductance sensor at the Lower Choptank station was ruled bad data starting from September 10 to October 8. After reviewing the pre-recovery-CTD-DO and post-recovery-CTD-DO cast deployment data after a couple of station visits, the instrument indicates the data collected had a difference of -6.0 S/m or more. The difference is outside the standardized interval of whether the data status should be good.



## Example 3

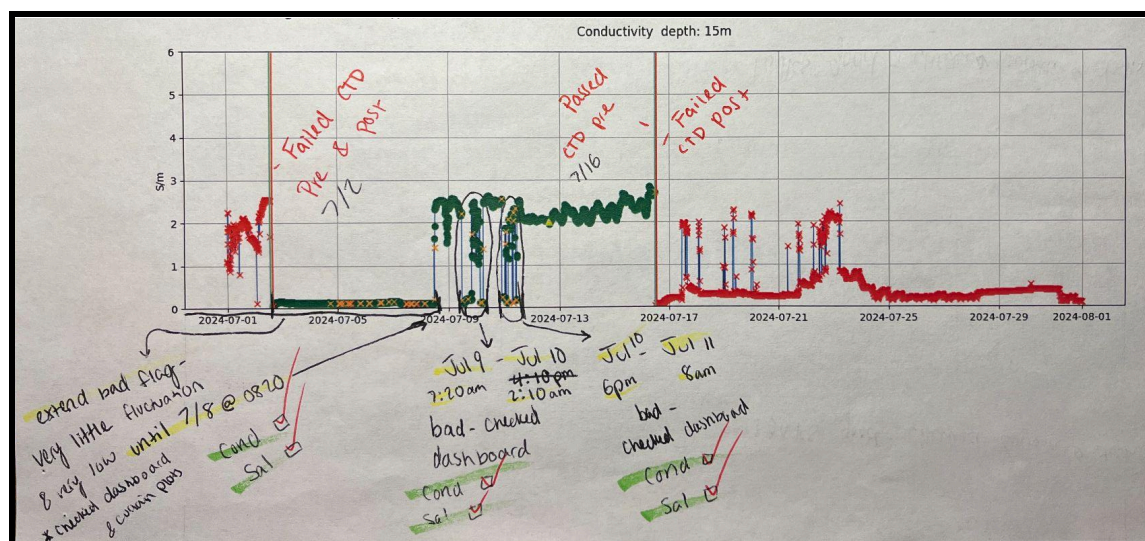


Image 13. On July 7, this conductance sensor failed its pre- and post-recovery-CTD-DO cast. The bad flag was extended until July 8 due to the noticeable low S/m flatline after the maintenance visit. The sensor seems to fluctuate between very low conductance readings to normal values in between the two maintenance visits, the dates with abnormal readings similar to the flatlined values were marked as bad. These fluctuations take place from July 9 to July 11, and then the sensor seems to return to normal function up until the following maintenance visit, where it passed the pre-recovery-CTD-DO cast.

## Example 4

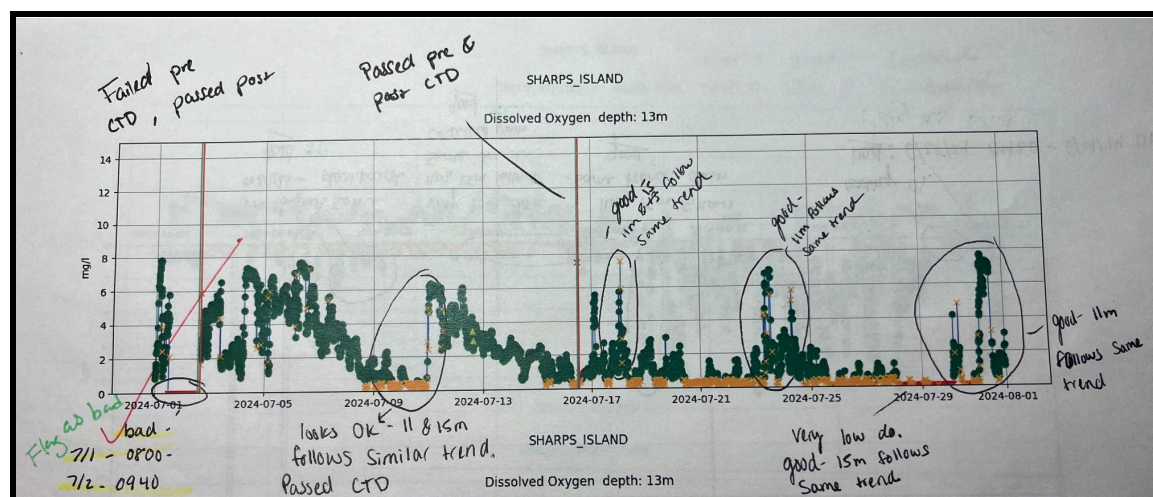


Image 14. A dissolved oxygen sensor failed on July 1. DO values dropped to 0 and remained until maintenance was performed on July 2. This sensor was swapped for a functioning one and verified with the post-recovery-CTD-DO cast. The rest of the data was compared to DO at similar depths, and all spikes observed follow the same pattern at 11m and 15m.



## Example 5

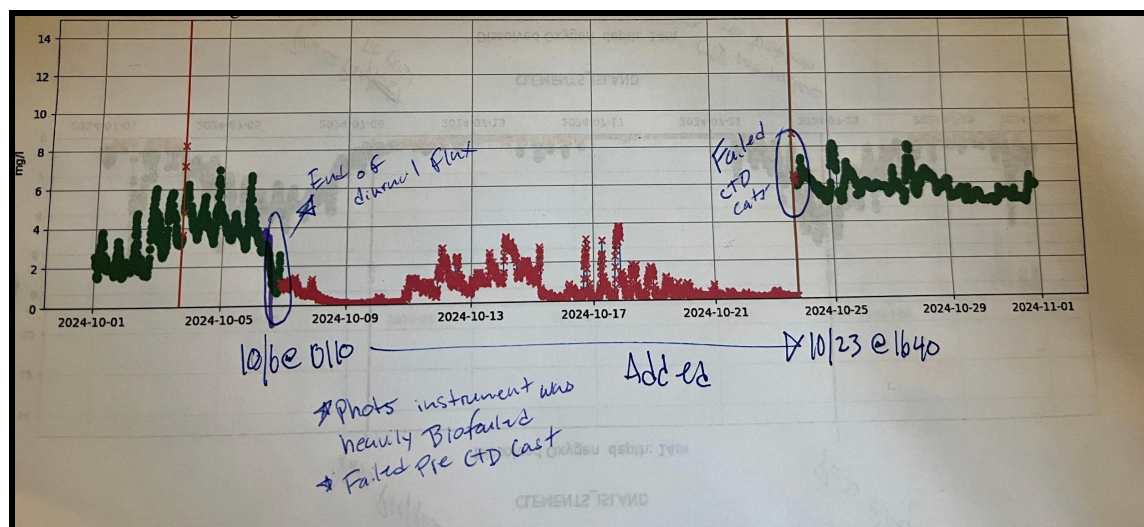


Image 15: A dissolved oxygen sensor failed the pre-recovery CTD-DO cast on October 23. Review of the data using internal plotting software, coupled with photographic evidence of extensive biofouling on the instrument, indicated that data degradation commenced on October 6. Furthermore, the abrupt increase in DO concentration (mg/L) observed on October 23 strongly suggests instrument malfunction.

## Example 6

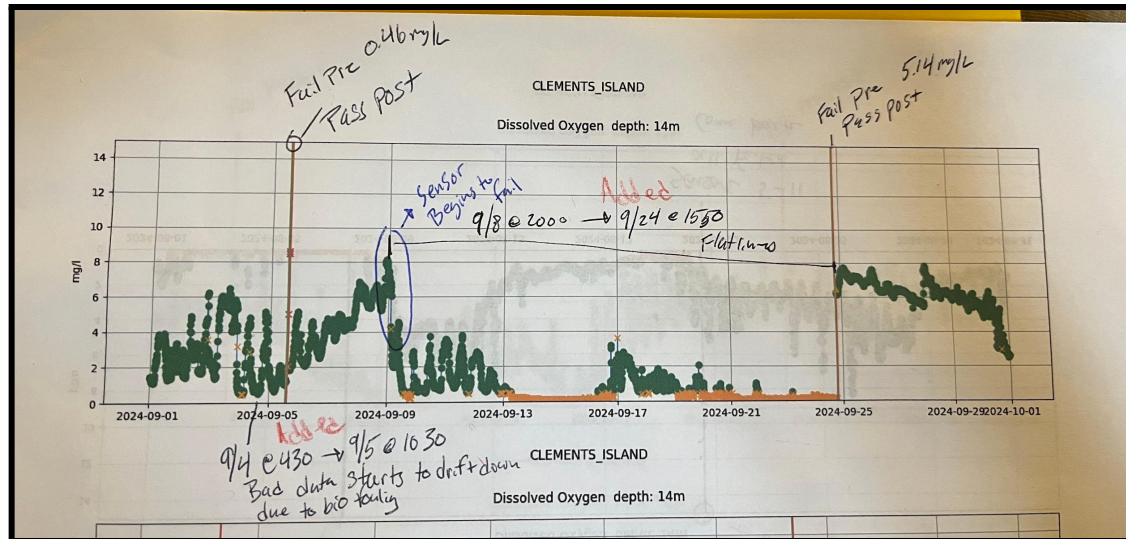


Image 16: Illustration of two instances of manual dissolved oxygen (DO) data-quality flag application. First, a “bad” flag was applied between September 4 and 5 due to the sensor failing the pre-recovery CTD-DO cast. While the failure was marginal, it was attributed to the onset of biofouling on the instrument. Reviewers are instructed to flag data as “bad” when DO fluctuations no longer correlate with the diurnal cycles observed in other sensors, as biofouling tends to dampen these fluctuations. Second, between September 8 and 24, the sensor exhibited a clear failure, indicated by the data “flatlining” at 0.00 mg/L and a subsequent failure of the pre-recovery CTD-DO cast.

5.2 Year-over-Year Data Refinement

The overall performance of the data collected is a useful aspect in understanding whether the methods or equipment used to maintain the buoy stations are beneficial in ways that produce a higher quantity of good data. After reviewing the quantified data from 2023 and 2024, there was a substantial increase in good data and decrease in bad data between the two seasons (Table 11 and 12). Calculations were made from using the weighted percent change formula:  $((\text{New Value 2024} - \text{Old Value 2023}) / \text{Old Value 2023}) * 100\%$ . Lower Choptank had a 40% or more percent change in good data from 2023 to 2024 from all water parameters. Lower Potomac had at least a 30% increase in good data from 2023 to 2024 from all water parameters.

Lower Choptank	Good Data % Change	Suspect Data % Change	Bad Data % Change
Temperature	60.65	-93.71	-96.41
Conductivity	151.66	-97.99	-99.96
Salinity	71.59	-96.46	-89.40
Dissolved Oxygen	41.48	-68.33	-73.85
Dissolved Oxygen Salinity Adjusted	124.92	-85.98	-73.57

Table 11. Data quality percent change from the end of the year 2023 season and 2024 season for Lower Choptank.

Lower Potomac	Good Data % Change	Suspect Data % Change	Bad Data % Change
Temperature	34.12	89.75	-94.42
Conductivity	162.02	-96.18	-99.80
Salinity	200.80	385.93	-95.41
Dissolved Oxygen	34.21	22.18	-87.32
Dissolved Oxygen Salinity Adjusted	174.48	-64.12	-87.13

Table 12. Data quality percent change from the end of the year 2023 season and 2024 season for Lower Potomac.

5.3 Manual Flags Index

This document details the manual data-quality flags applied to the dataset, as displayed on the internal QA/QC dashboard (Appendices). For each applied flag, the following information is provided: station location, quality-control classification (good, suspect, bad), sensor depth, measured parameter, flag start and end times, rationale for flag application, and any additional relevant notes. This section serves as a reference for data reviewers, enabling them to understand the basis for all applied data-quality flags.

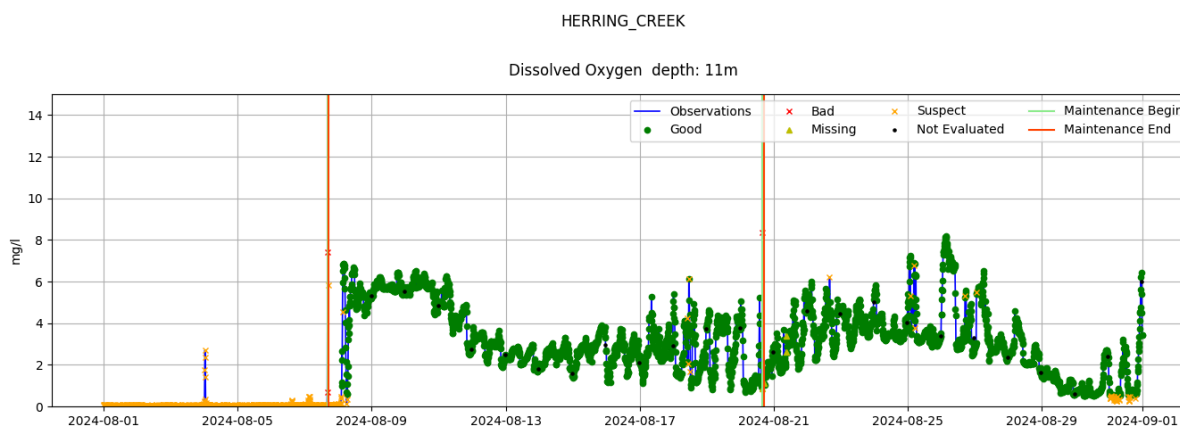
5.4 Notable Data Observations

The most pronounced data-quality challenges during the 2024 monitoring season were at the Herring Creek station, primarily concerning DO measurements. The consistent observation of near-zero DO concentrations presented a significant interpretive difficulty. Specifically, the established CTD-DO tolerance threshold of 0.5 mg/L DO (used by Michael et al., 2021) , while intended to accommodate natural variability, proved insufficient for accurately validating DO fluctuations within the extremely low range of 0.1 to 0.01 mg/L. This challenge was exemplified by instances where

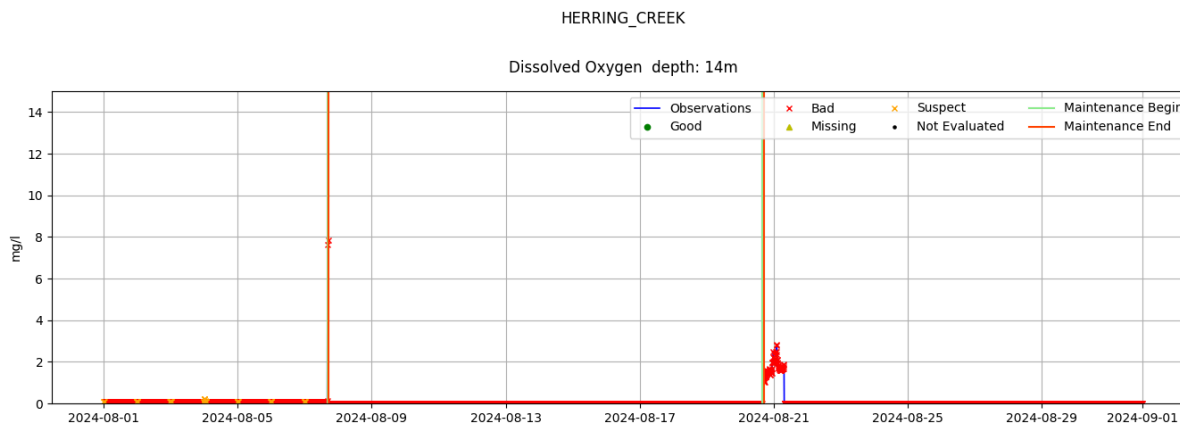
a sensor deployed at 11 m depth exhibited a typical diurnal DO cycle, fluctuating between 6.0 mg/L and 1.5 mg/L (Image 17), while a sensor positioned at 14 m depth simultaneously recorded DO levels between 0.065 mg/L and 0.063 mg/L (Image 18). This minimal fluctuation at depth was consistently flagged by automated data-quality control systems as a “flat line,” yet it routinely passed the CTD-DO validation test, which allowed for a 0.5 mg/L tolerance. These low readings continued to be observed after an entirely new sensor was installed at the location.

The determination of the validity of these near-zero DO readings proved problematic. The absence of robust historical data from this specific location, coupled with the lack of comparable observations from other monitoring sites, exacerbated the uncertainty. While theoretical models predict the existence of persistent hypoxic or anoxic zones, direct empirical validation of such conditions at Herring Creek remained inconclusive. This raised questions regarding the potential for localized microstratification or other unique environmental conditions influencing the observed DO levels.

Conversely, instances where sensors registered a definitive 0.00 mg/L, with no variability in the tenths, hundredths, or thousandths decimal places, were unequivocally classified as “bad” data. These readings were deemed indicative of complete sensor malfunction, as the lack of any variability strongly suggested a failure in the sensor’s measurement capabilities. This clear distinction between near-zero fluctuations and absolute zero readings facilitated a more refined and accurate assessment of data quality, particularly within the challenging environmental context of the Herring Creek station.



*Image 17: August 2024 DO measurements from the Herring Creek station at a depth of 11 meters reveals expected fluctuations in DO concentrations from August 9 onward. Specifically, the data exhibit diurnal variability, indicative of typical biological and physical processes influencing DO levels within the water column. These fluctuations are consistent with anticipated patterns in estuarine environments, reflecting the dynamic interplay of factors such as photosynthesis, respiration, and water column mixing.*



*Image 18: DO measurements at the Herring Creek station, specifically at a depth of 14 meters during August 2024, reveals a distinct pattern. From August 1 to August 8, the sensor recorded minimal fluctuations in DO concentrations, with readings consistently oscillating between 0.065 mg/L and 0.063 mg/L. Following August 8, the sensor appears to have ceased functioning, as evidenced by a cessation of meaningful data output. This abrupt change in sensor behavior suggests a potential malfunction or failure of the instrument or an incorrect deployment depth that resulted in the sensor lying within the seabed sediments.*

## 5.5 Instrument Outputs

### Calculated Measurements

The hypoxia buoys collect a suite of metadata every 10 minutes to determine the functionality of sensors in an effort to accurately measure temperature ( $^{\circ}\text{C}$ ), conductivity (S/m), DO concentration (mg/L), and pressure (db). Additionally, the buoy computers have the ability to continuously calculate salinity (S/m) and salinity-adjusted DO (mg/L) from the prior measurements.

### Salinity-Adjusted Dissolved Oxygen Calculation

Salinity-adjusted DO is calculated to more accurately measure the oxygen concentration in seawater, as its concentration can be influenced by factors including temperature and salinity. When water temperature and salinity change, they can affect the solubility of oxygen in seawater. Warmer water generally holds less DO, while higher salinity can increase oxygen solubility. To isolate the effect of salinity on DO concentration, researchers use salinity-adjusted DO values.

The adjustment is typically done using the oxygen solubility values corresponding to specific temperature and salinity conditions. By normalizing the DO measurements to a standard salinity level, usually expressed as DO concentrations at a reference salinity of 35 parts per thousand (ppt), scientists can compare oxygen levels across different water masses and locations more accurately.

This salinity adjustment allows for the identification of patterns and variations in DO concentrations that are independent of changes in salinity, providing a clearer understanding of the underlying processes affecting oxygen distribution in the ocean. It is especially important for comparing data collected from different regions with varying

salinity levels, making the interpretation and analysis of DO data more robust in the context of oceanographic research and environmental monitoring.

- The equation to compensate DO readings for salinity is:  

$$DO\_C = :DO * \exp(-1 * :SAL * (0.017674 + (-10.754 + 2140.7 / :TEMPK) / :TEMPK))$$
 Where :DO is the measured DO in mg/l, :SAL is the salinity in g/kg brine, and :TEMPK is the water temperature in Kelvin.
- The equation to express DO as a percent of saturation is:  

$$DO\% = (:DO\_C / :DOSAT) * 100$$
 Where :DO\_C is the compensated DO reading in mg/l and :DOSAT is the DO saturation value in mg/l at the measured temperature and salinity.
- The equation to calculate DO saturation in mg/l is:  

$$DOSAT = \exp(-139.34411 + (1.575701E5 + (-6.642308E7 + (1.2438E10 - 8.621949E11 / :TEMPK) / :TEMPK) / :TEMPK) / :TEMPK) * \exp(-1 * :SAL * (0.017674 + (-10.754 + 2140.7 / :TEMPK) / :TEMPK))$$
 Where :SAL is the measured salinity in g/kg brine and :TEMPK is the water temperature in Kelvin.

Source: Benson, B.B. and Krause Jr, D., 1984.

### Calculating Salinity from Conductivity

The relationship between electrical conductivity and salinity is used to estimate salinity in seawater. This method is based on the fact that the electrical conductivity of seawater is primarily influenced by the concentration of dissolved ions, which in turn is related to salinity.

The most commonly used formula for salinity estimation from conductivity is the Practical Salinity Scale (PSS-78), which relates conductivity, temperature, and pressure to salinity. The formula takes into account the variations in seawater properties with depth and temperature.

$$S = C (15^t) / K$$

Where:

- S is the salinity,
- C is the conductivity,
- t is the temperature in degrees Celsius, and
- K is a constant related to specific instrument calibration.

Source: Rice, E.W., Bridgewater, L. and American Public Health Association eds., 2012

### Interpreting Good, Suspect, and Bad Data

In collecting data for this project, immense effort was undertaken to ensure data could be backed by *in situ* measurements guided by methods established by regional partners. Robust quality-control measures were implemented to assess and categorize the data as either good, bad, or suspect, forming a critical framework to ensure the accuracy and reliability of the collected information. These measures ensure the accuracy and reliability of the



collected information by adhering to set protocols. NCBO systematically evaluates data points, applying stringent criteria to distinguish between high-quality, acceptable data, and instances where data integrity may be compromised.

Of important note, while data is classified into quality categories, users have the discretion to determine its application and significance. In this project, methods adapted from the guidelines in Michael et al., 2021, and as indicated in NOAA Chesapeake Bay Office, 2023, were systematically followed to categorize data. Users can independently assess data reliability, recognizing that its significance may vary based on the specific application.

### Acceptable Data

Acceptable data is referred to in this document as “good data.” The sensor has undergone a thorough review and is operating under optimal conditions. This data meets predefined criteria, standards, or quality-control measures, indicating its reliability. Acceptability is determined by comparing the data to established benchmarks, ensuring it is free from significant errors, biases, or anomalies that could compromise the validity and reliability of results. Additionally, the data has been either directly compared against equivalent sensors in controlled conditions or compared against third-party sensors deployed in the field.

### Suspect Data

Suspect data is referred to in this document as “suspect data.” Suspect data refers to measurements that may be questionable or raise concerns about accuracy, reliability, or validity. Sensors reporting suspect data before field deployment are returned to the manufacturer for troubleshooting. This classification arises when a sensor deployed in the field begins to exhibit erroneous data compared to an independent sensor. Suspect data may result from equipment malfunctions, calibration errors, and environmental variability, requiring further investigation. The data is considered usable for analysis if additional evidence suggests the erroneous data could be due to variability in the water column. However, it is crucial to acknowledge errors observed during CTD-DO validation casts or potential bias by changing data classification as discussed earlier in this section.

### Bad Data

Bad data is referred to in this document as “bad data.” Bad data refers to measurements that are deemed unreliable, inaccurate, or unsuitable for the intended purpose due to significant errors, inconsistencies, or anomalies. This type of data does not meet the established quality standards or criteria set for in the QAPP and should not be considered for making assessments of quantified environmental conditions.

### Data Deliverables

Data requests can be made through NCBO or found publicly available on <https://buoybay.noaa.gov/> via CSV file.

Headers will Include:

- Station Name"
- GPS Latitude (Deg)
- GPS Longitude (Deg)
- depth (m)
- Observation Timestamp (UTC)
- Sea Water Temperature (C)

- Sea Water Temperature (C) QC
- Conductivity (s/m)
- Conductivity QC
- Salinity (PSU)
- Salinity QC
- O2 Concentration (mg/l)
- O2 Concentration (mg/l) QC
- O2 Concentration Salinity Adjusted (mg/l)
- O2 Concentration Salinity Adjusted (mg/l) QC
- x0\_o2\_sol\_\_mg\_l
- x0\_o2salfactor
- Pressure (dbar)

## 5.6 Data Discussion

### Interpreting Data

The data acquired from the six deployed buoys—located at Sharps Island, Chlora Point, Lower Choptank, Lower Potomac, Herring Creek, and Clements Island—provide valuable insights into key water-quality variables, including temperature, conductivity, salinity, dissolved oxygen (DO), and salinity-adjusted DO. The percentage of data classified as “good,” “suspect,” “bad,” or “good and suspect” is presented for each parameter at each station.

Overall, the 2024 data collection efforts demonstrated a marked improvement in data capture and reliability compared to previous years. This enhanced performance can be attributed to a confluence of factors. The increased availability of spare parts, particularly replacement sensors, allowed for rapid responses to equipment malfunctions and minimized data gaps. The addition of personnel to the project team provided critical capacity for both field operations and data management, ensuring timely maintenance and more thorough quality-control procedures. Furthermore, the development and implementation of adaptive QA/QC protocols, refined through experience and tailored to the specific challenges of the Chesapeake Bay environment, contributed significantly to the improved data quality.

Another significant factor in the improved data collection success was the ability to maintain station deployments for extended periods, particularly during the winter and spring seasons. These colder months typically experience minimal biofouling. Biofouling is the primary driver of low-quality data and sensor malfunctions. Longer deployments during these periods allowed for the continuous collection of valuable data, unhindered by the frequent cleaning and maintenance required during the warmer, biofouling-prone months. However, as discussed in Section 5.4, the project encountered challenges in interpreting DO data exhibiting prolonged periods (weeks) at or below 0.01 mg/L. While this data often passed the established CTD-DO validation procedures, the accurate validation and ecological significance of such low DO concentrations remain a subject of ongoing investigation and require further scrutiny. Additionally, significant short-term fluctuations in DO were observed, with levels at any given depth often rising or falling by as much as 6 mg/L within a few hours. Understanding the drivers and implications of these rapid DO fluctuations is crucial for a complete assessment of water-quality dynamics.

In contrast to the challenges presented by DO data, temperature data exhibited exceptional consistency and reliability throughout the deployment period, with virtually no issues encountered. Similarly, conductance measurements, which posed the most significant challenges in 2023, showed substantial improvement in 2024. This notable improvement

may be attributed to a combination of factors, including potential shifts in the abundance and composition of biofouling organisms and the refinement and implementation of more effective cleaning methodologies. Despite the overall improvements, a notable amount of “unknown” data was recorded, the underlying causes of which warrant further investigation to ensure data completeness and accuracy. Finally, it is essential to reiterate that the deployed sensors lack inherent antibiofouling capabilities. The program relies on the use of attached screens and, critically, regular and meticulous maintenance during the biofouling season to mitigate the detrimental effects of biological growth on sensor performance and data quality. This underscores the importance of a robust and adaptive maintenance schedule for the long-term success of the monitoring program.

### **Conductivity**

- Chlora Point and Lower Choptank have the highest percentages of good conductivity data with 94.78% and 93.92%.
- Lower Potomac and Clements Island have the highest percentages of bad conductivity data with 0.13% and 0.12%.
- The percentage range for good conductivity data collected from all stations was from 76.06% to 94.78%.

### **Salinity**

- Chlora Point and Lower Choptank have the highest percentages of good salinity data with 94.90% and 89.21%.
- Clements Island and Herring Creek have the highest percentages of bad salinity data with 33.01% and 8.23%.
- The percentage range for good salinity data collected from all stations was from 62.56% to 94.90%.

### **Dissolved Oxygen**

- Chlora Point and Lower Choptank have the highest percentages of good dissolved oxygen data with 88.07% and 83.87%.
- Clements Island and Herring Creek have the highest percentages of bad dissolved oxygen data with 24.78% and 24.27%.
- The percentage range for good dissolved oxygen data collected from all stations was from 54.80% to 88.07%.

### **Temperature**

- Lower Choptank and Chlora Point have the highest percentage of good temperature data with 92.07% and 89.34%.
- Clements Island and Herring Creek have the highest percentage of bad temperature data with 13.39% and 9.72%.
- The percentage range for good temperature data collected from all stations was from 71.03% to 92.07%.

### **Dissolved Oxygen Salinity Adjusted**

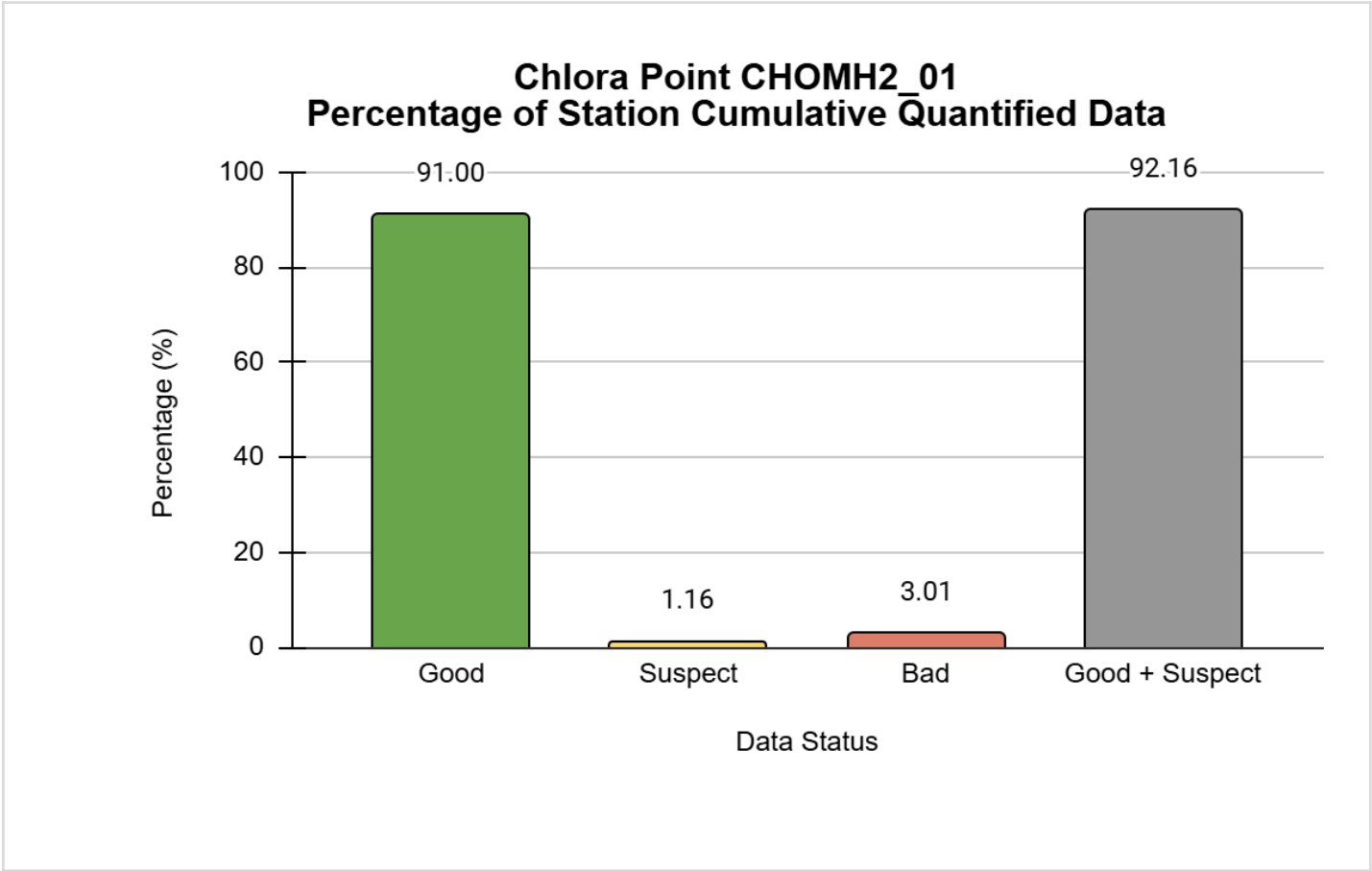
- Chlora Point and Lower Choptank have the highest percentage of good dissolved oxygen salinity adjusted data with 87.89% and 83.67%.
- Clements Island and Herring Creek have the highest percentage of bad dissolved oxygen salinity adjusted data with 24.78% and 24.27%.
- The percentage range for good dissolved oxygen salinity adjusted data collected from all stations was from 54.50% to 87.89%.

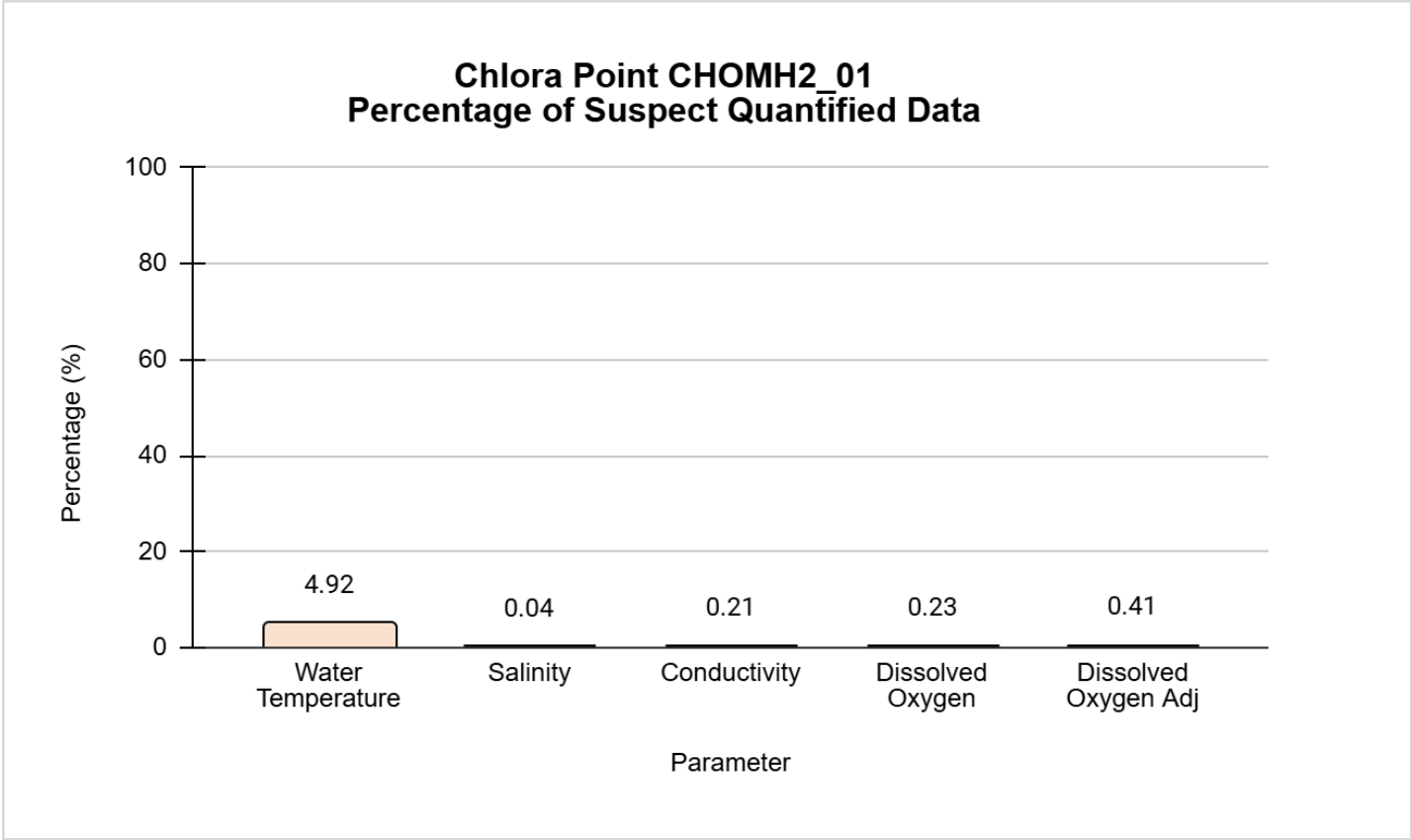
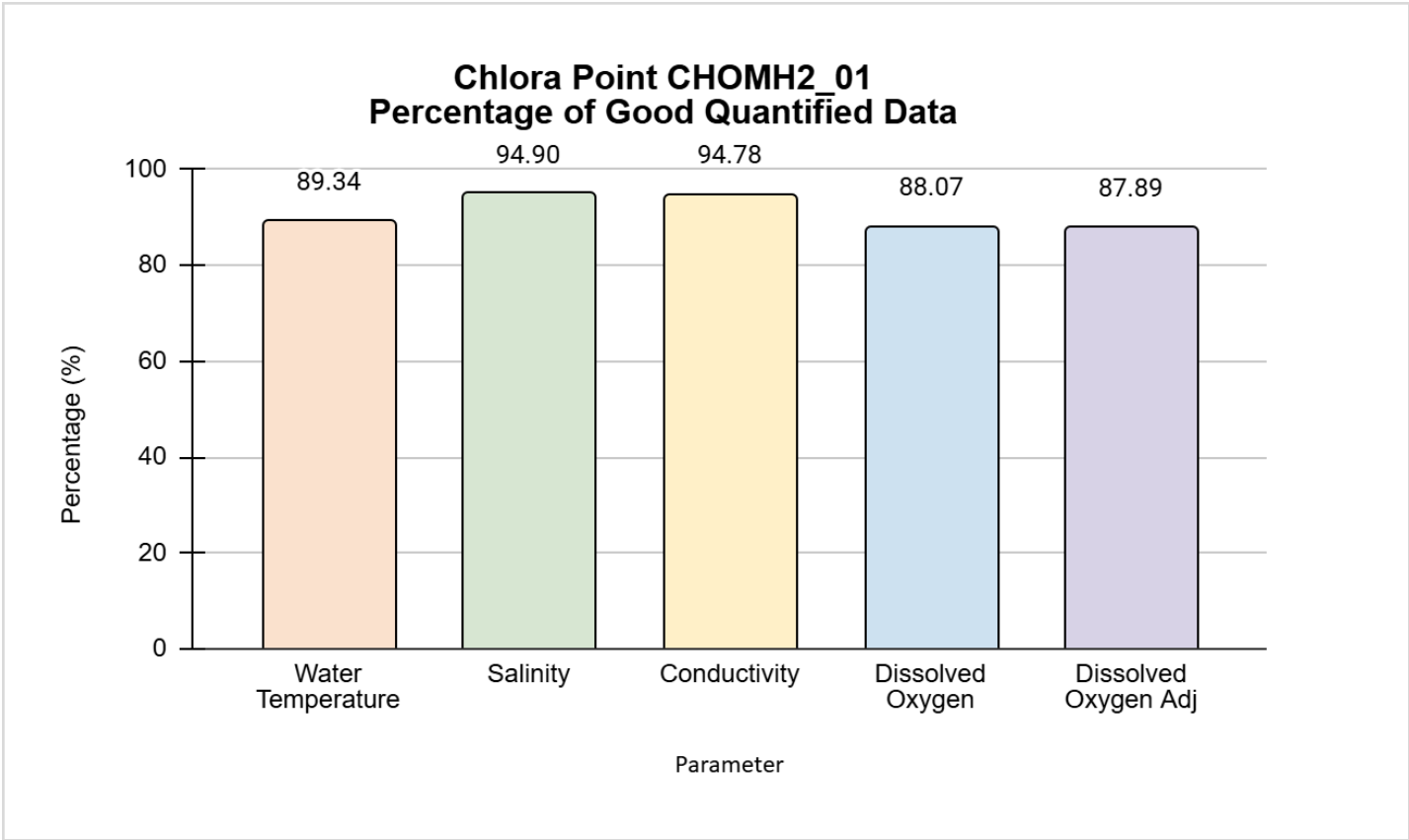


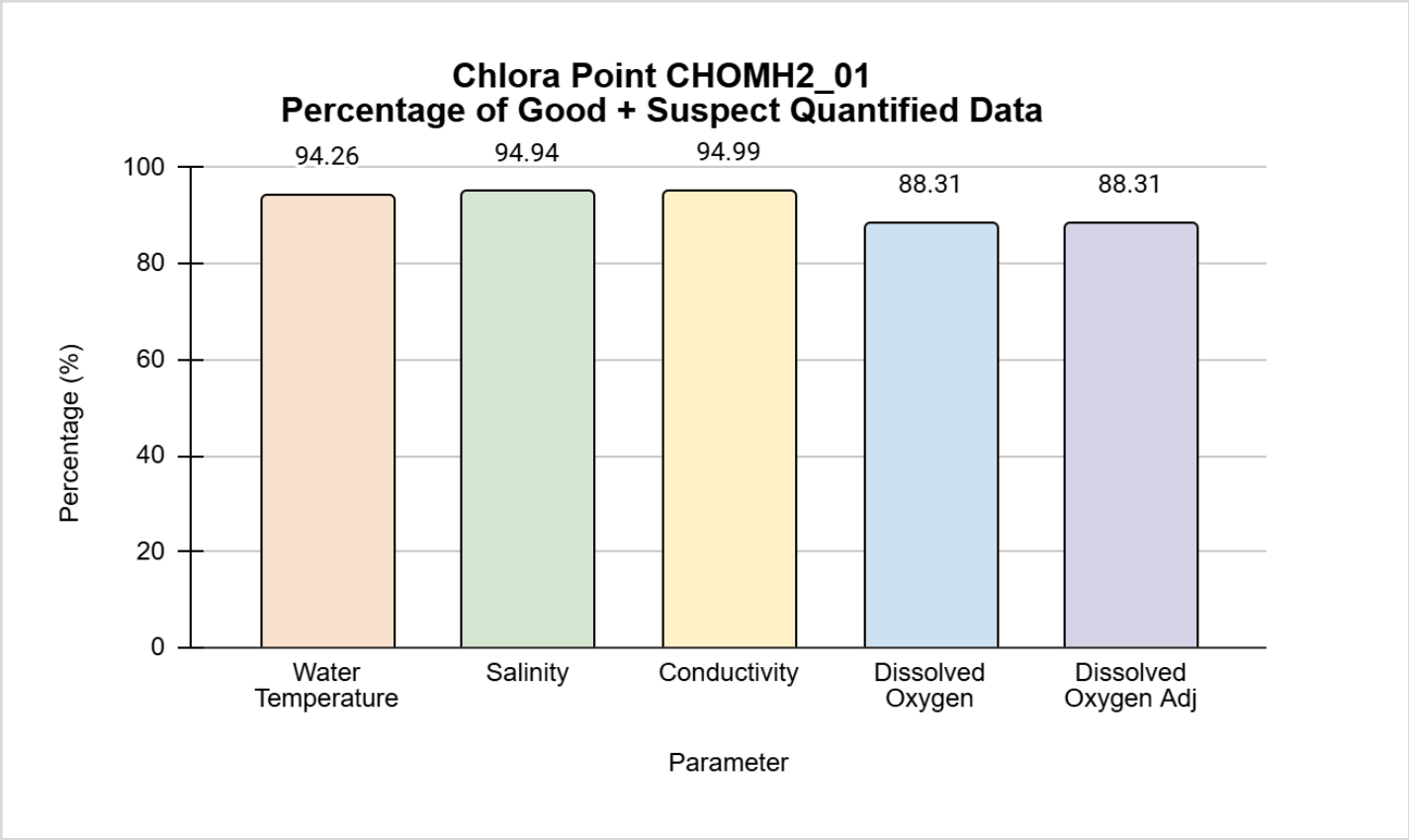
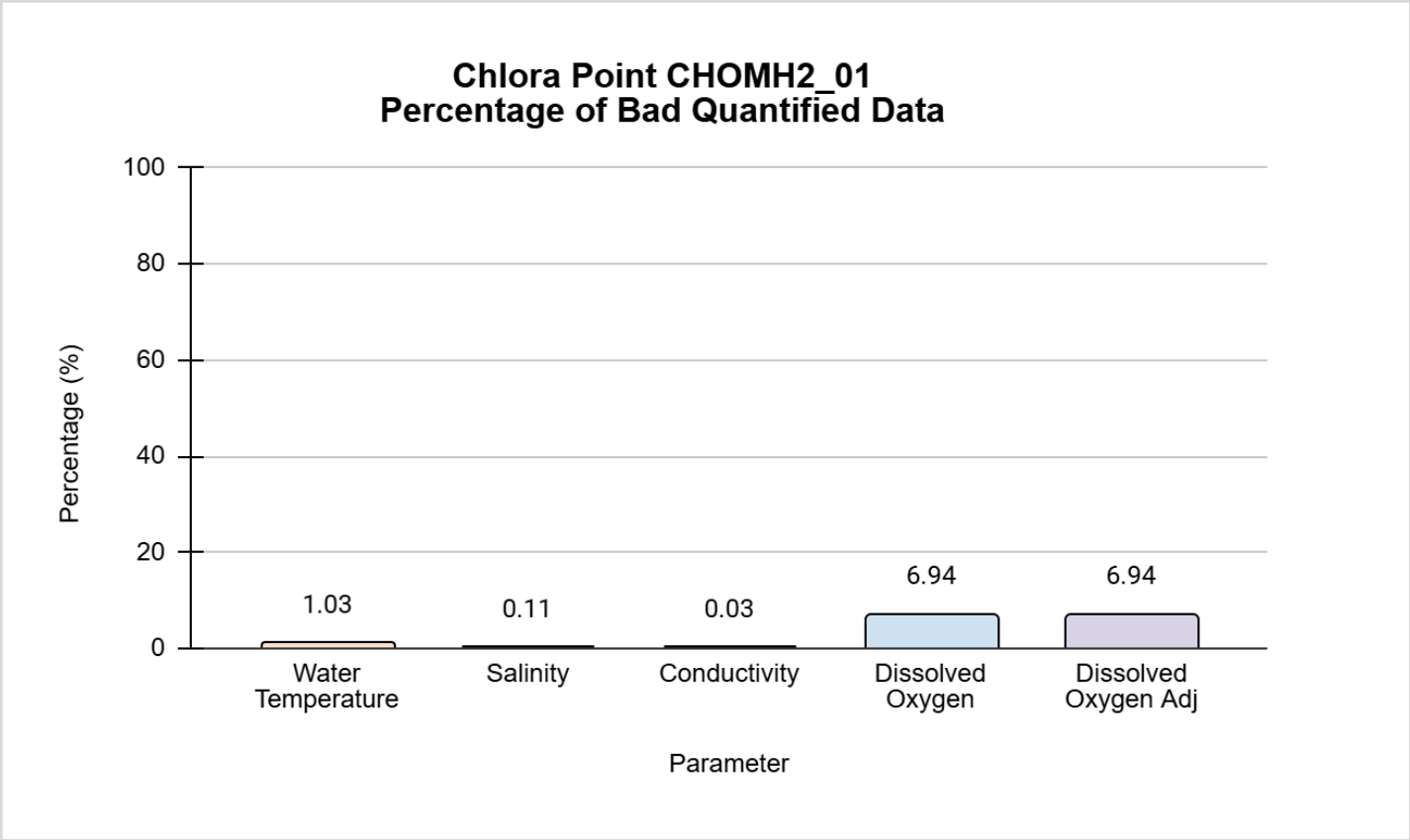
# 6. Deployed Location Metrics

## 6.1 Chlora Point Metrics

### Chlora Point Figures





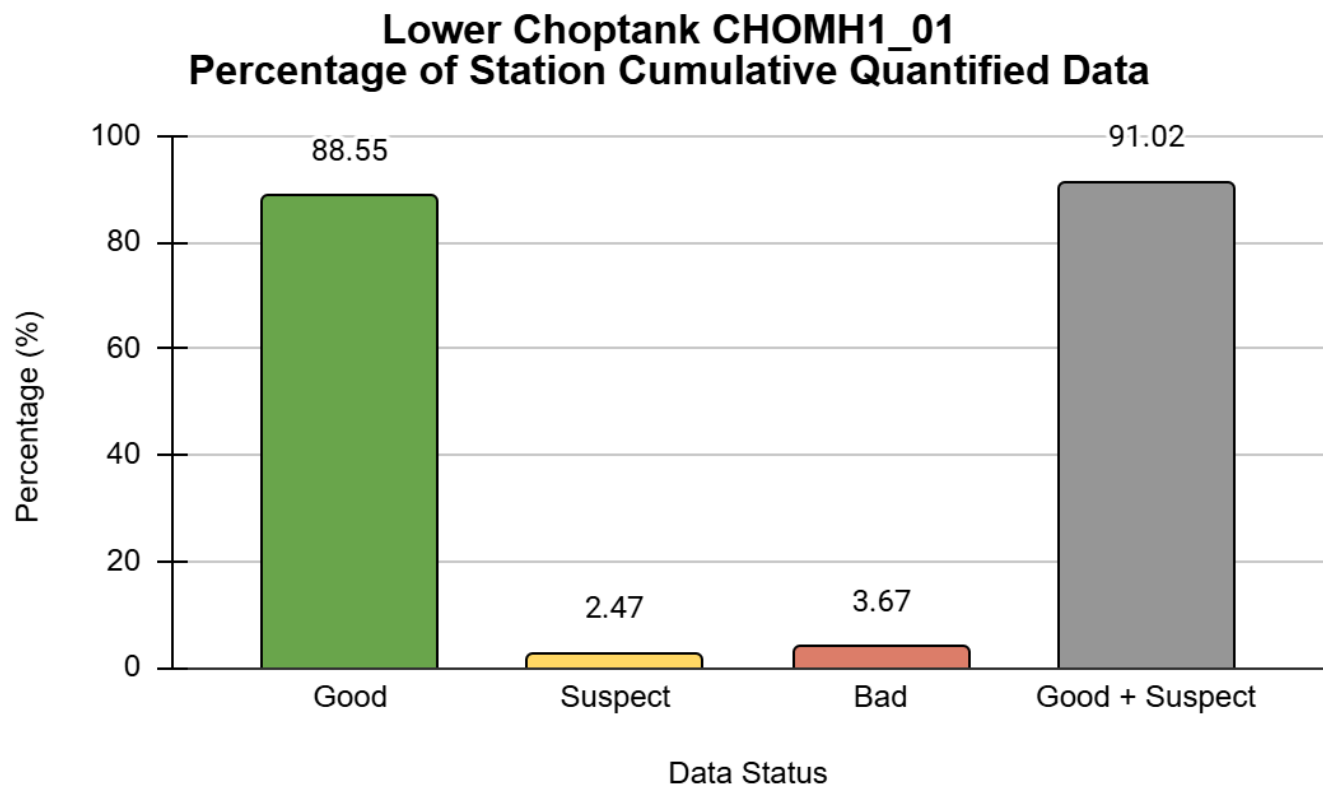


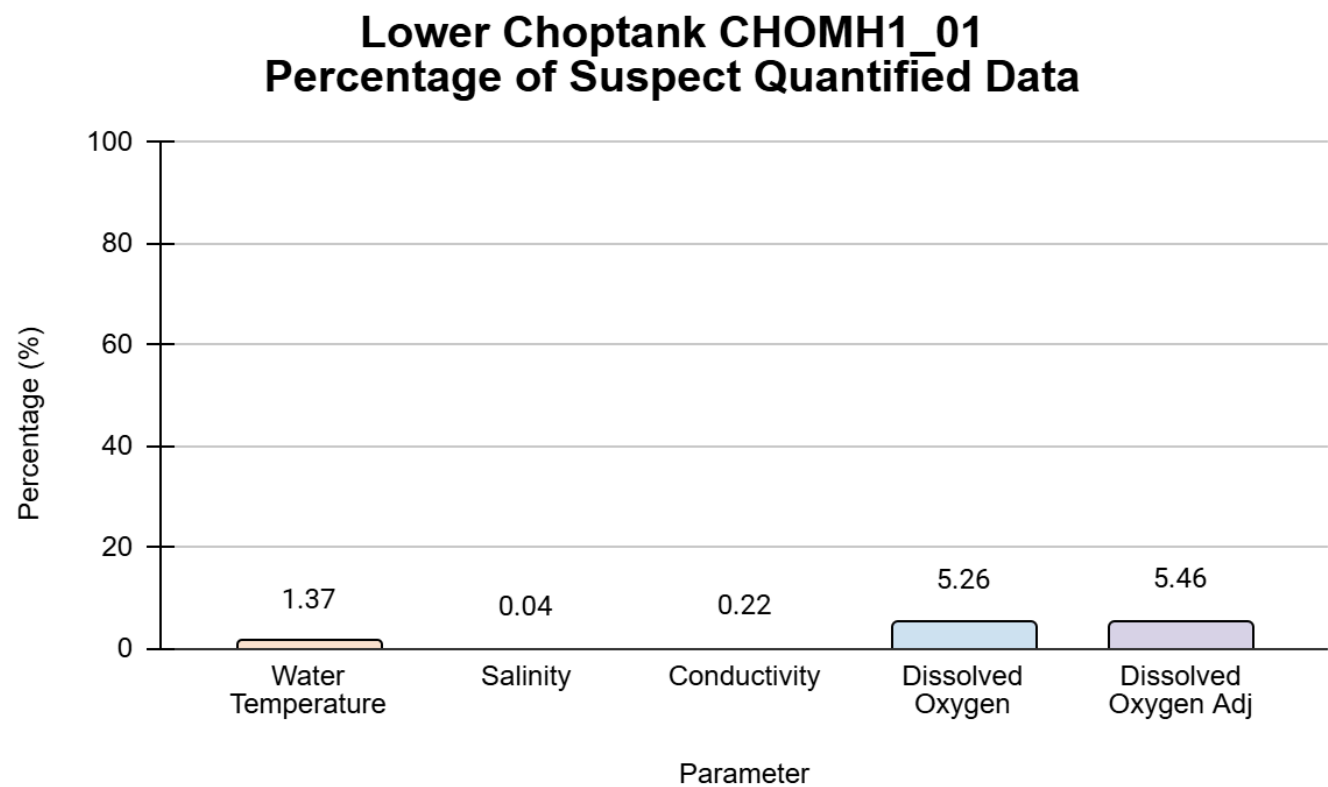
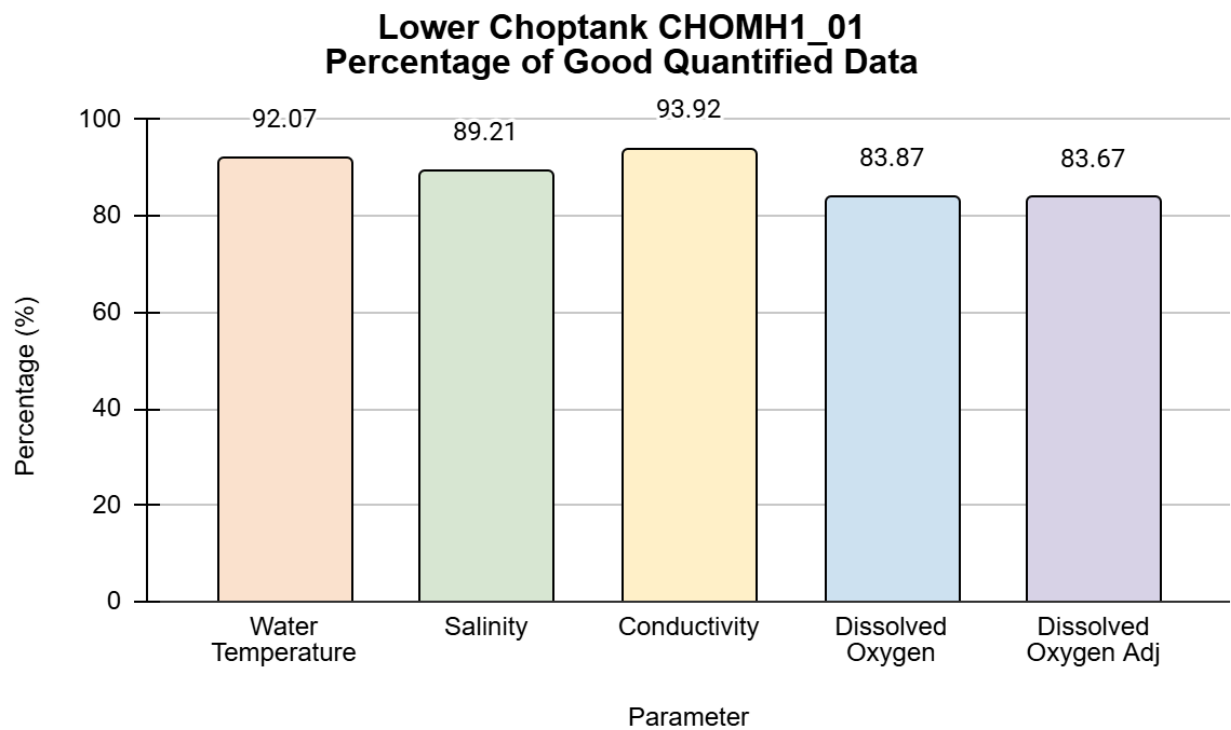
## Chlora Point Tables

Chlora Point - Good Data	% of Quantified Data
Water Temperature	89.34
Salinity	94.90
Conductivity	94.78
Dissolved Oxygen	88.07
Dissolved Oxygen Adj	87.89
Chlora Point- Suspect Data	% of Quantified Data
Water Temperature	4.92
Salinity	0.04
Conductivity	0.21
Dissolved Oxygen	0.23
Dissolved Oxygen Adj	0.41
Chlora Point - Bad Data	% of Quantified Data
Water Temperature	1.03
Salinity	0.11
Conductivity	0.03
Dissolved Oxygen	6.94
Dissolved Oxygen Adj	6.94
Chlora Point - Good + Suspect Data	% of Quantified Data
Water Temperature	94.26
Salinity	94.94
Conductivity	94.99
Dissolved Oxygen	88.31
Dissolved Oxygen Adj	88.31
Chlora Point - Whole Station	% of Quantified Data
Good	91.00
Suspect	1.16
Bad	3.01
Good + Suspect	92.16

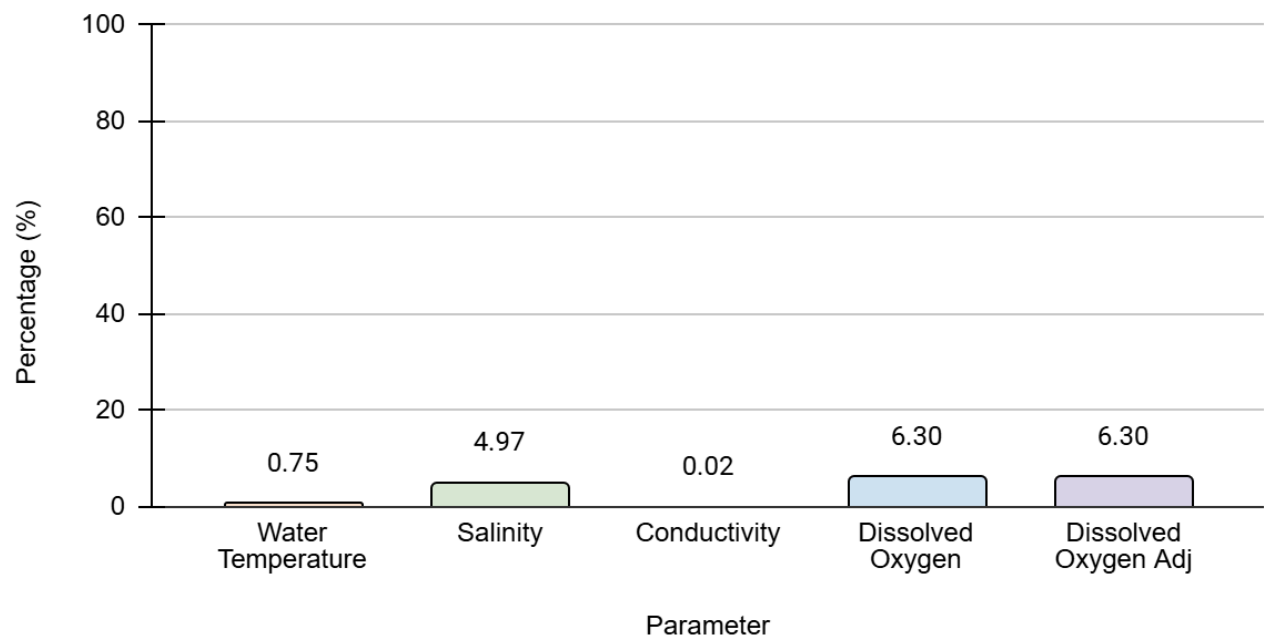
6.2 Lower Choptank Metrics

Lower Choptank Figures

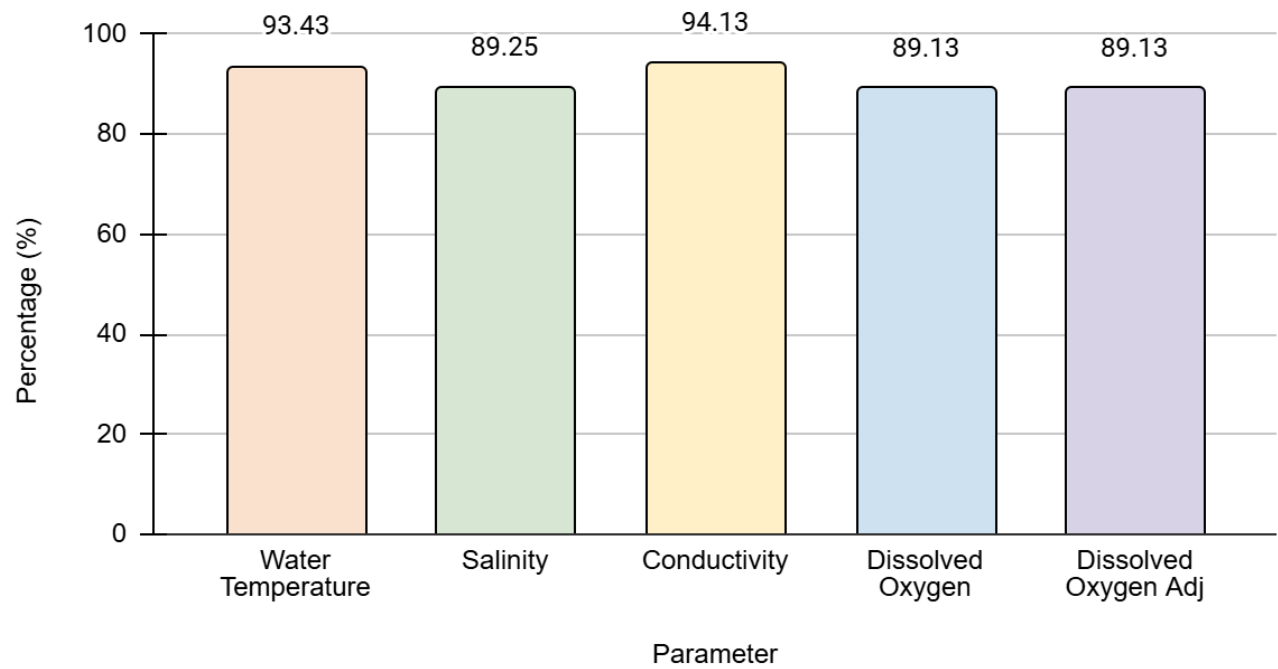




Lower Choptank CHOMH1\_01  
Percentage of Bad Quantified Data



Lower Choptank CHOMH1\_01  
Percentage of Good + Suspect Quantified Data



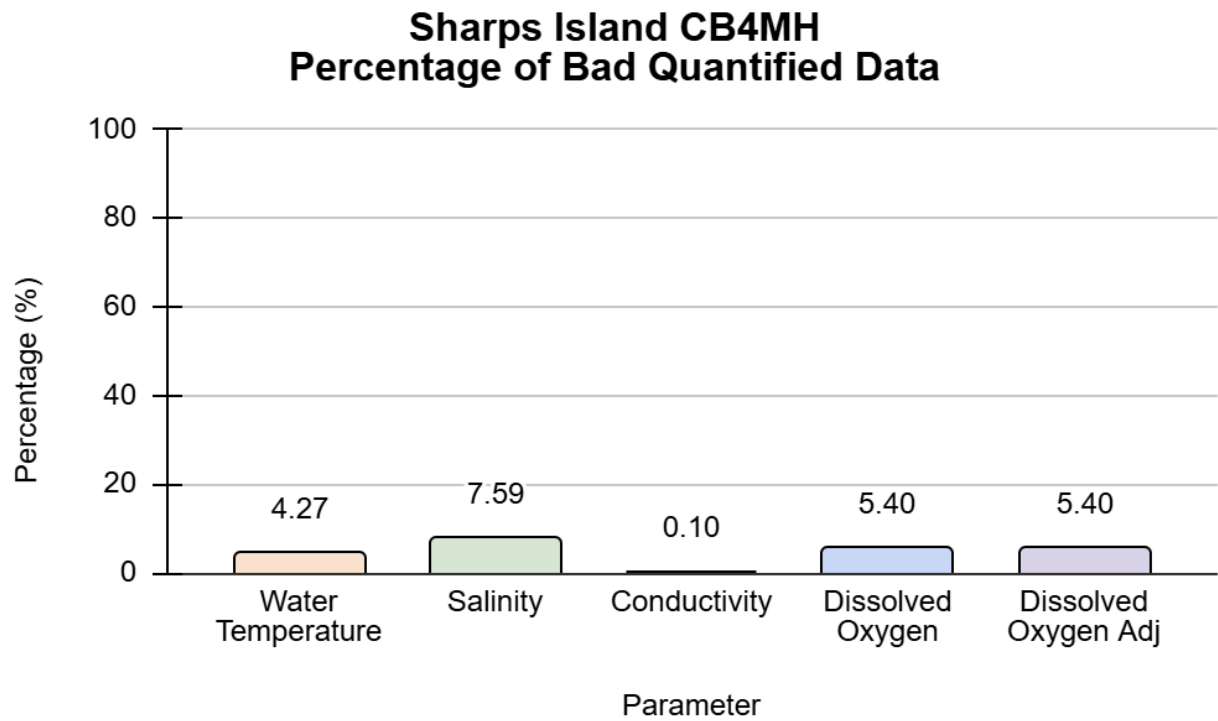
## Lower Choptank Tables

Lower Choptank - Good Data	% of Quantified Data
Water Temperature	92.07
Salinity	89.21
Conductivity	93.92
Dissolved Oxygen	83.87
Dissolved Oxygen Adj	83.67
Lower Choptank - Suspect Data	% of Quantified Data
Water Temperature	1.37
Salinity	0.04
Conductivity	0.22
Dissolved Oxygen	5.26
Dissolved Oxygen Adj	5.46
Lower Choptank - Bad Data	% of Quantified Data
Water Temperature	0.75
Salinity	4.97
Conductivity	0.02
Dissolved Oxygen	6.30
Dissolved Oxygen Adj	6.30
Lower Choptank - Good + Suspect	% of Quantified Data
Water Temperature	93.43
Salinity	89.25
Conductivity	94.13
Dissolved Oxygen	89.13
Dissolved Oxygen Adj	89.13
Lower Choptank - Whole Station	% of Quantified Data
Good	88.55
Suspect	2.47
Bad	3.67
Good + Suspect	91.02

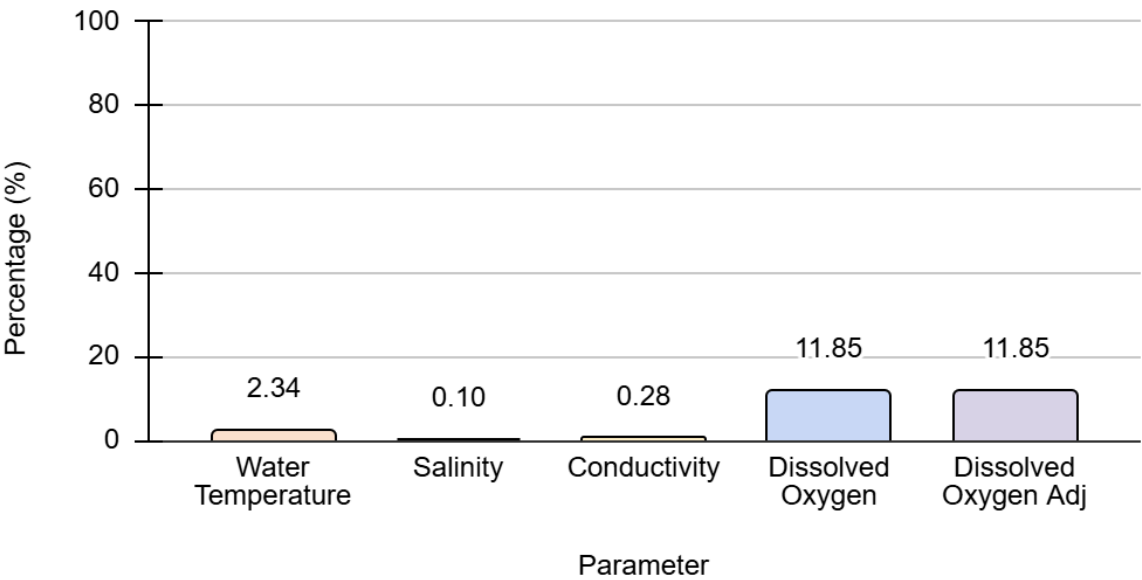


6.3 Sharps Island Metrics

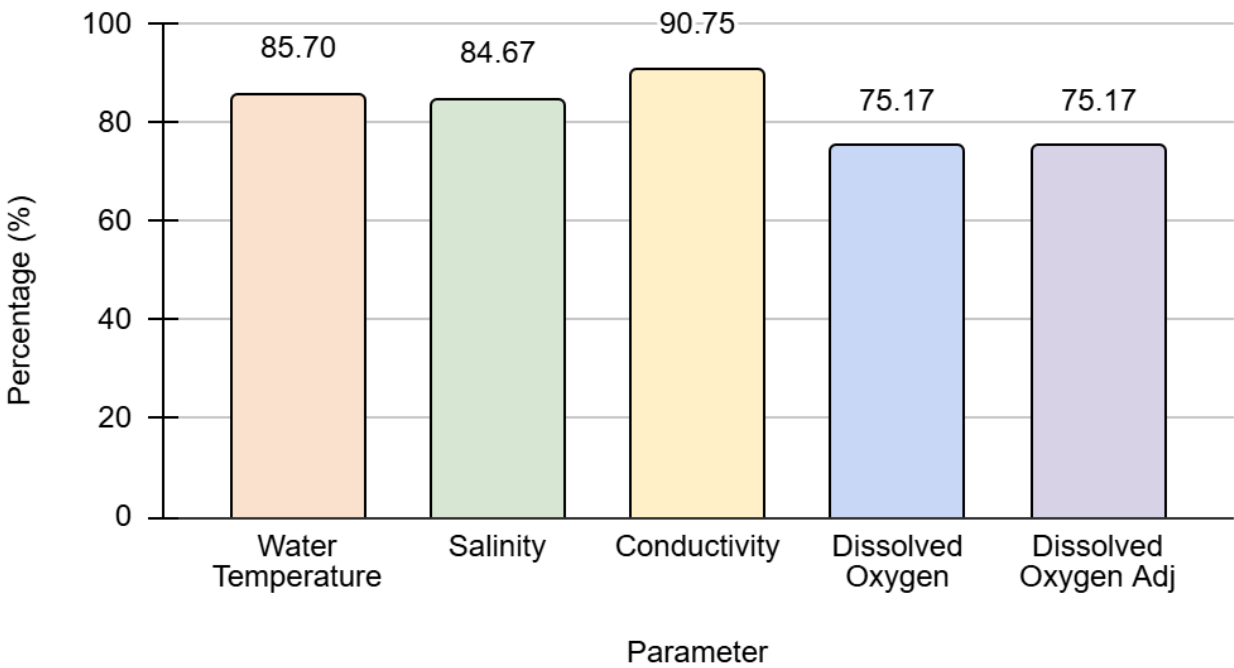
Sharps Island Figures

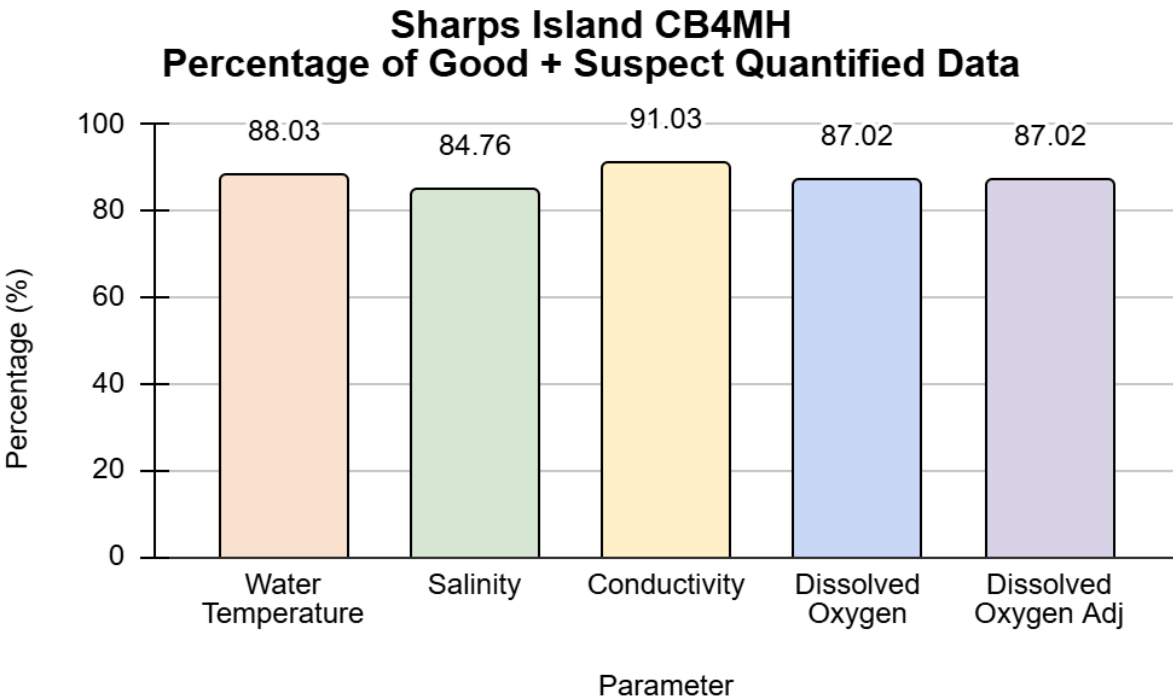
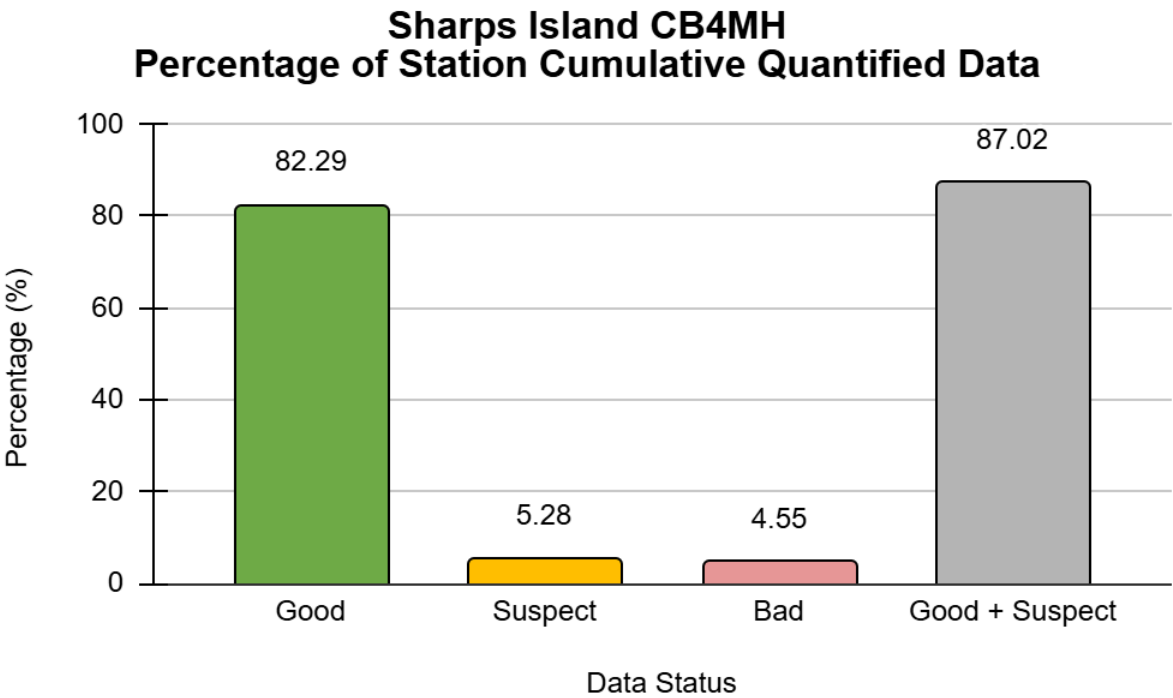


Sharps Island Sharps Island CB4MH  
Percentage of Suspect Quantified Data



Sharps Island CB4MH Percentage of Good Quantified Data



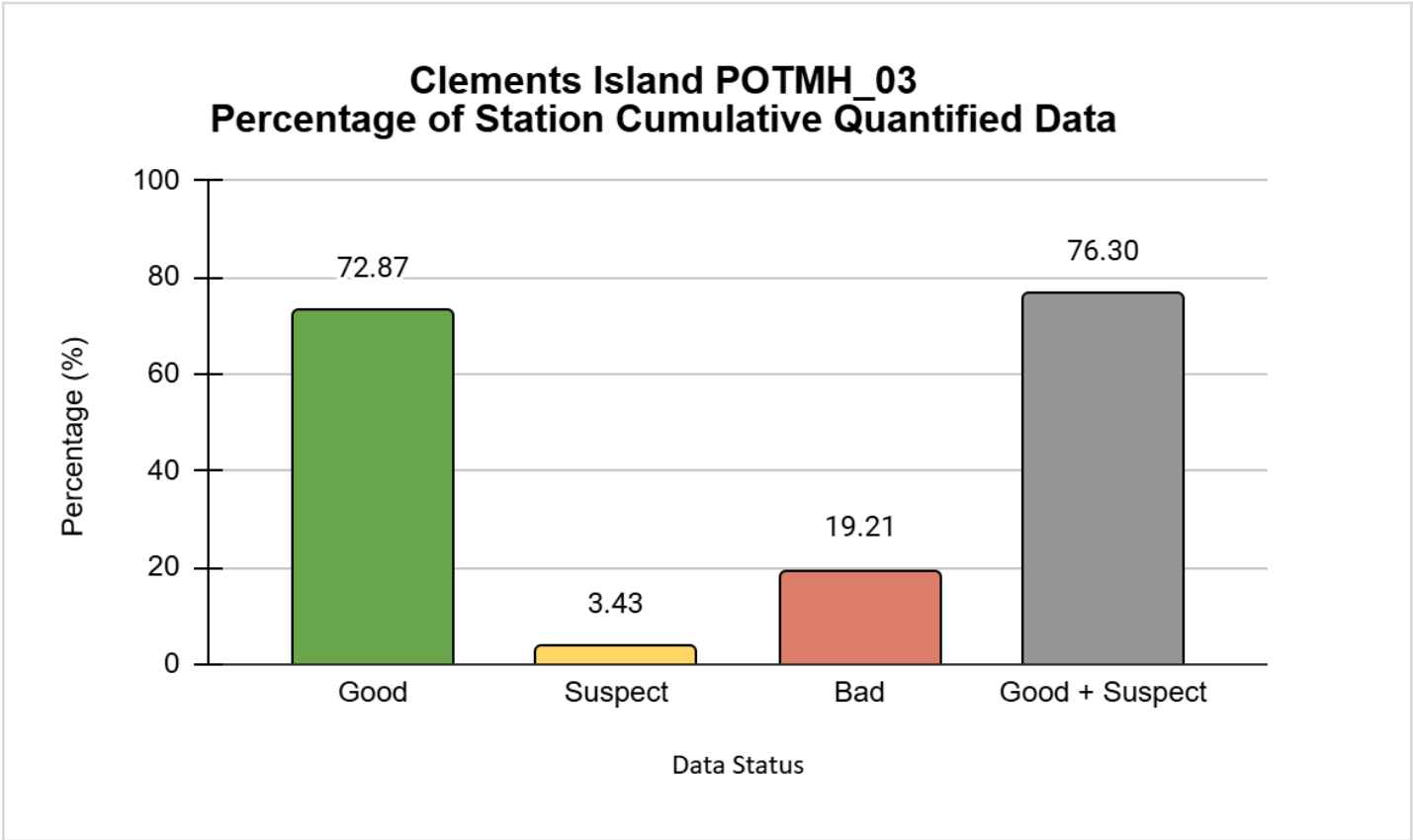


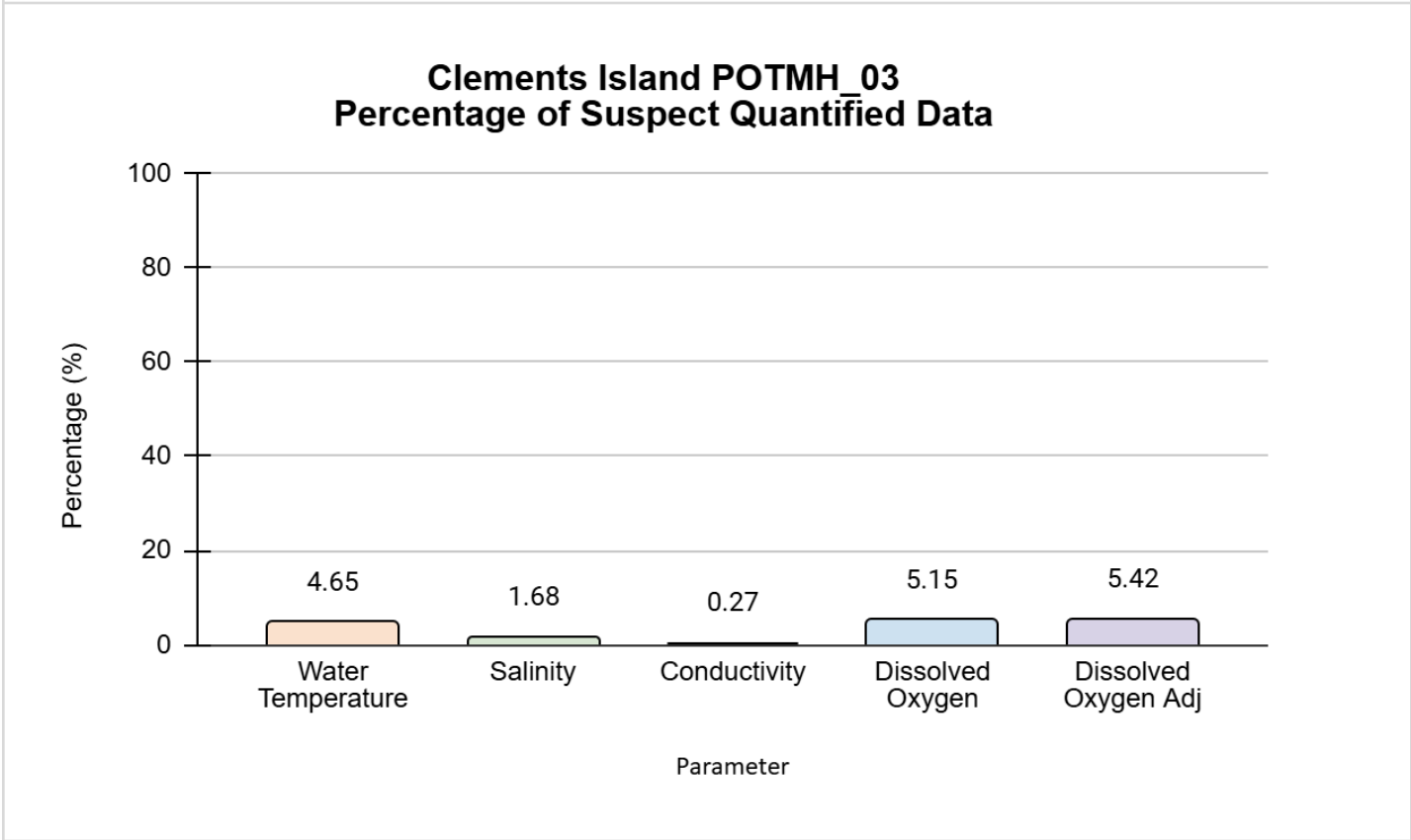
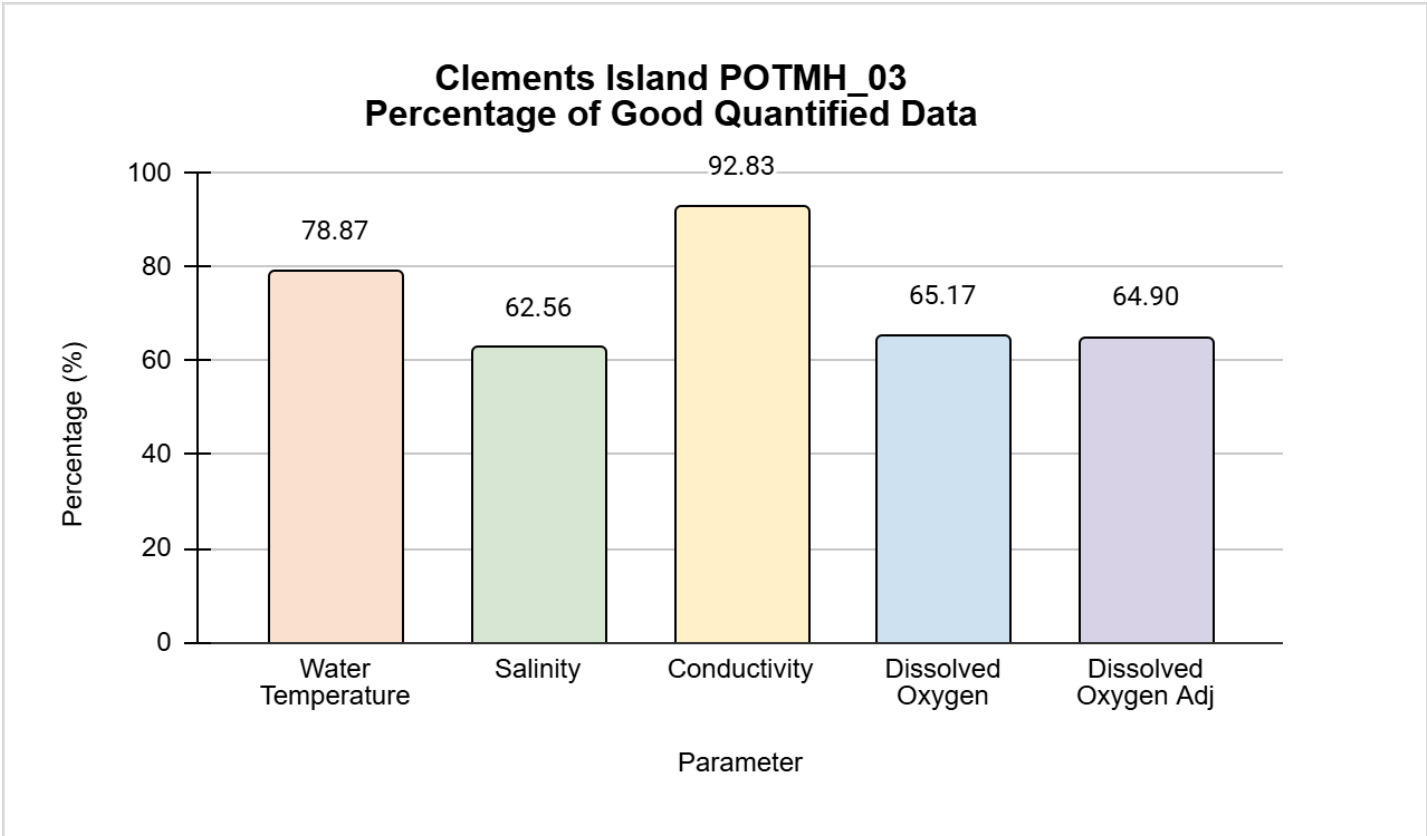
## Sharps Island Tables

Sharps Island - Good Data	% of Quantified Data
Water Temperature	85.70
Salinity	84.67
Conductivity	90.75
Dissolved Oxygen	75.17
Dissolved Oxygen Adj	75.17
Sharps Island - Suspect Data	% of Quantified Data
Water Temperature	2.34
Salinity	0.10
Conductivity	0.28
Dissolved Oxygen	11.85
Dissolved Oxygen Adj	11.85
Sharps Island - Bad Data	% of Quantified Data
Water Temperature	4.27
Salinity	7.59
Conductivity	0.10
Dissolved Oxygen	5.40
Dissolved Oxygen Adj	5.40
Sharps Island - Good + Suspect Data	% of Quantified Data
Water Temperature	88.03
Salinity	84.76
Conductivity	91.03
Dissolved Oxygen	87.02
Dissolved Oxygen Adj	87.02
Sharps Island - Whole Station	% of Quantified Data
Good	82.29
Suspect	5.28
Bad	4.55
Good + Suspect	87.02

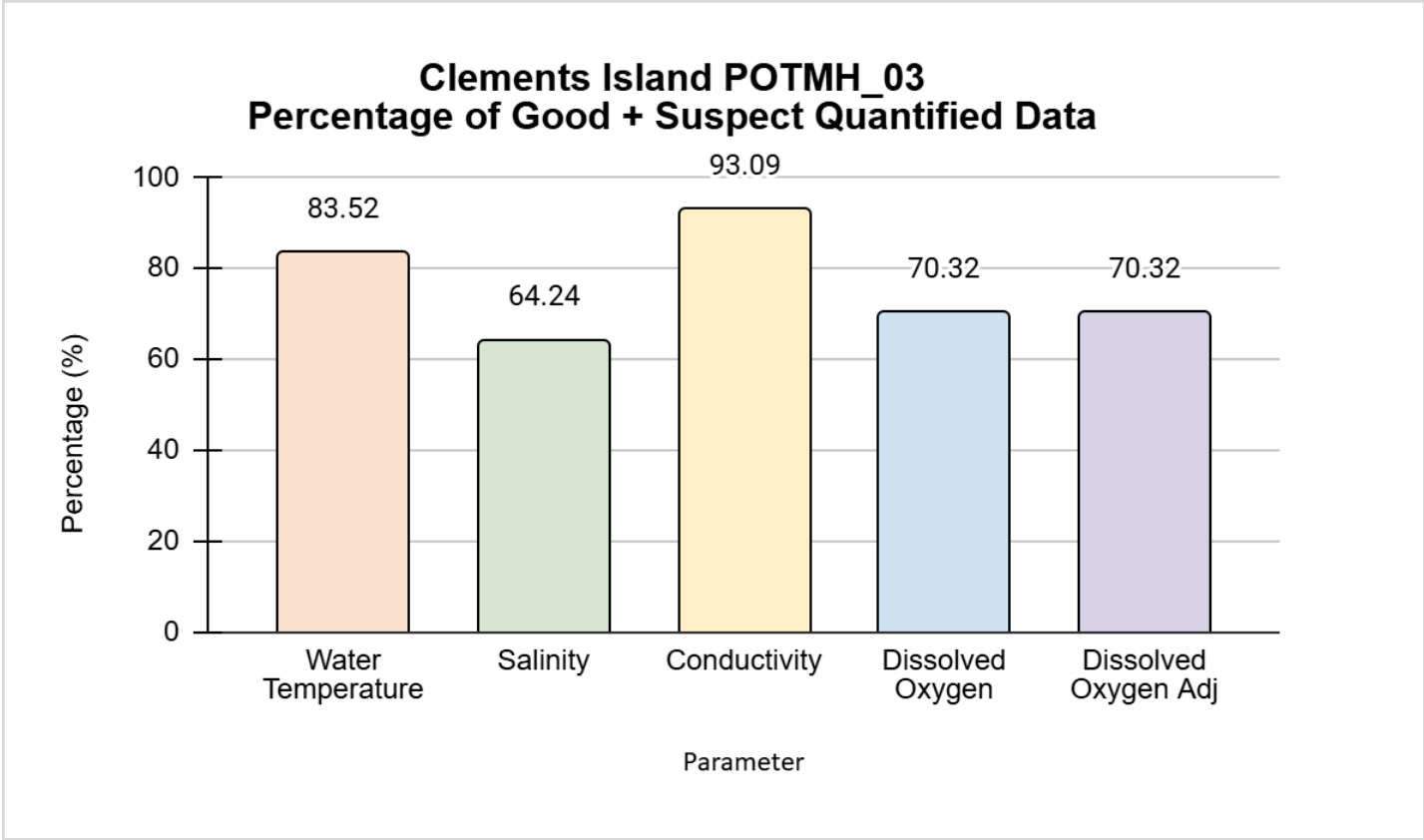
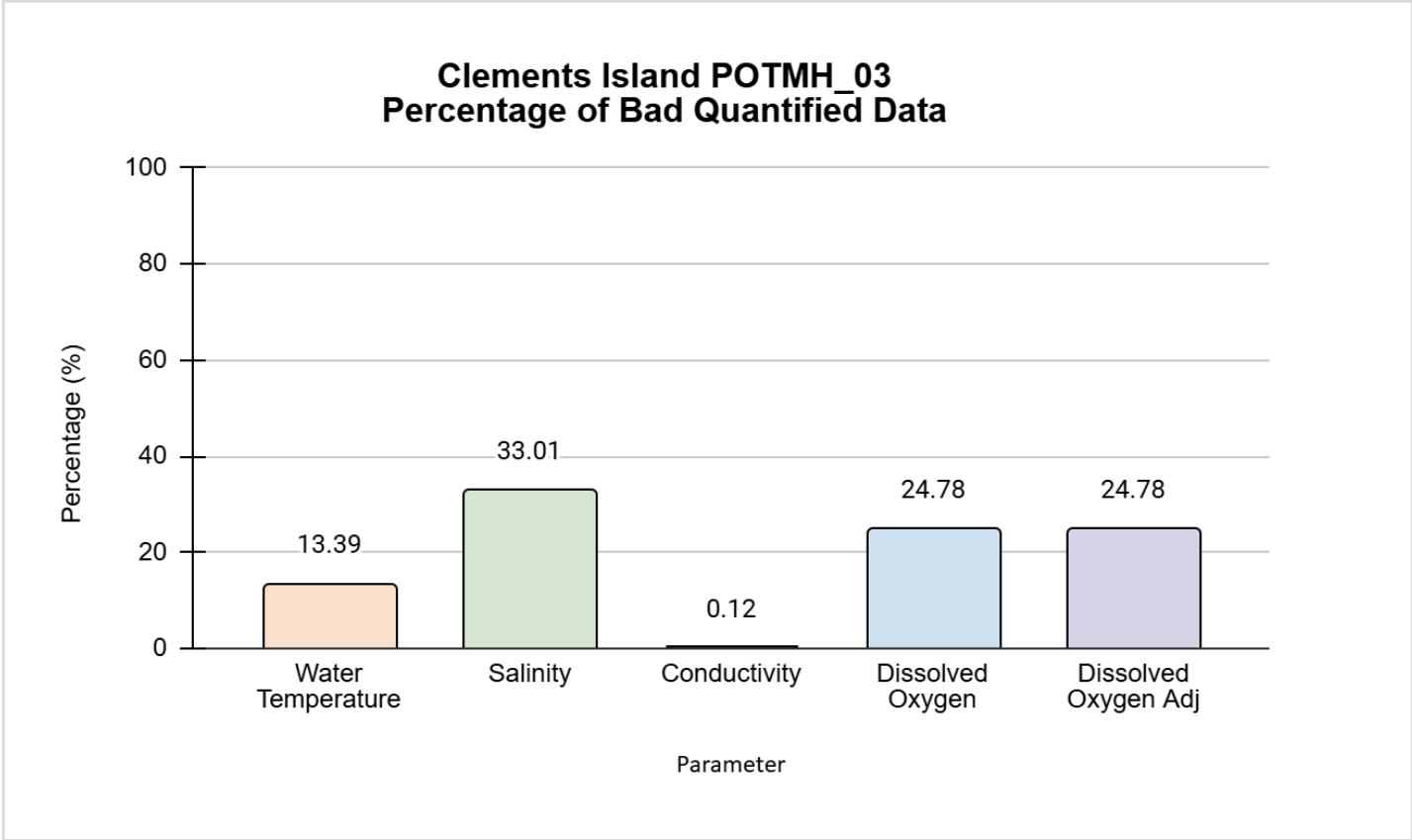
6.4 Clements Island Metrics

Clements Island Figures







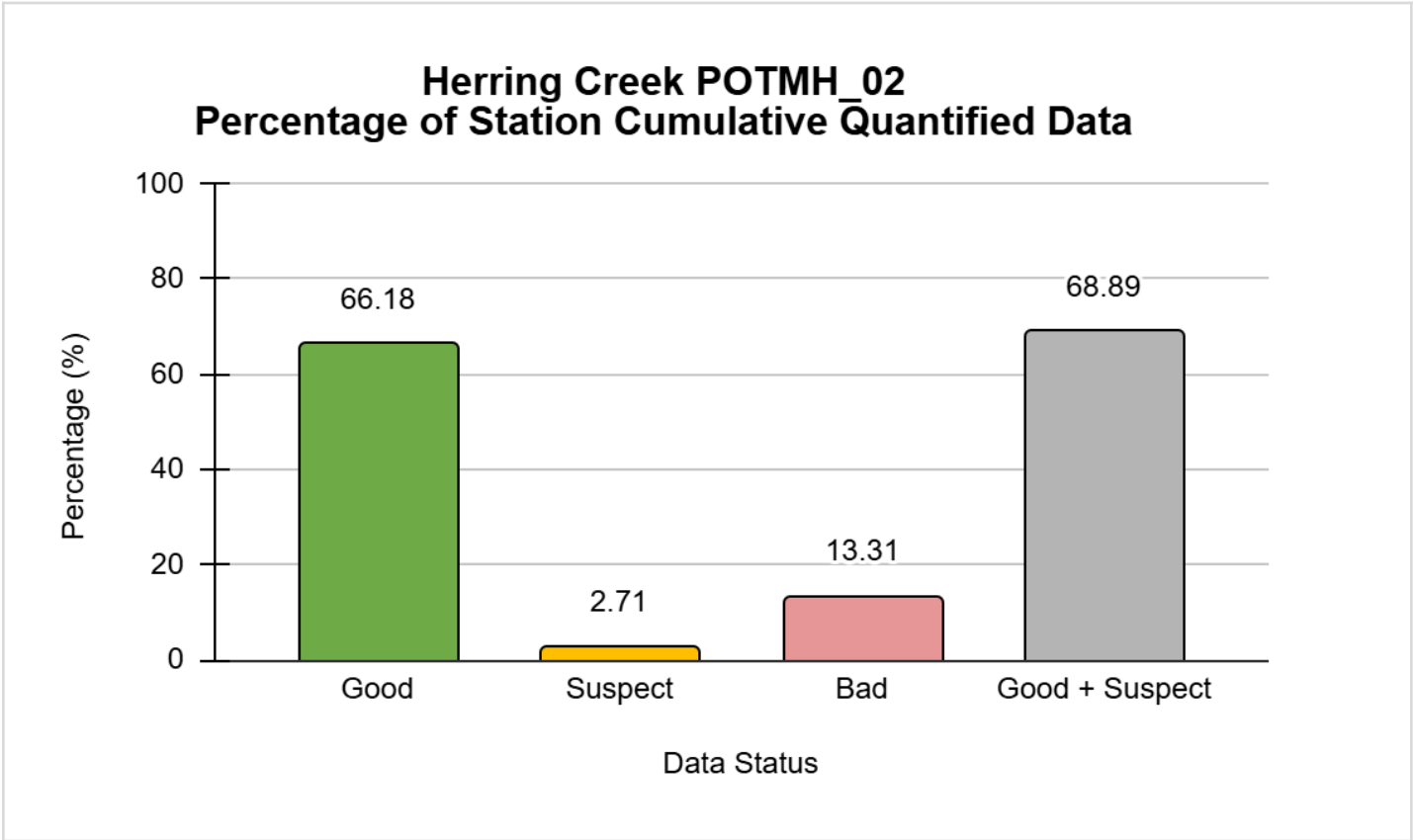


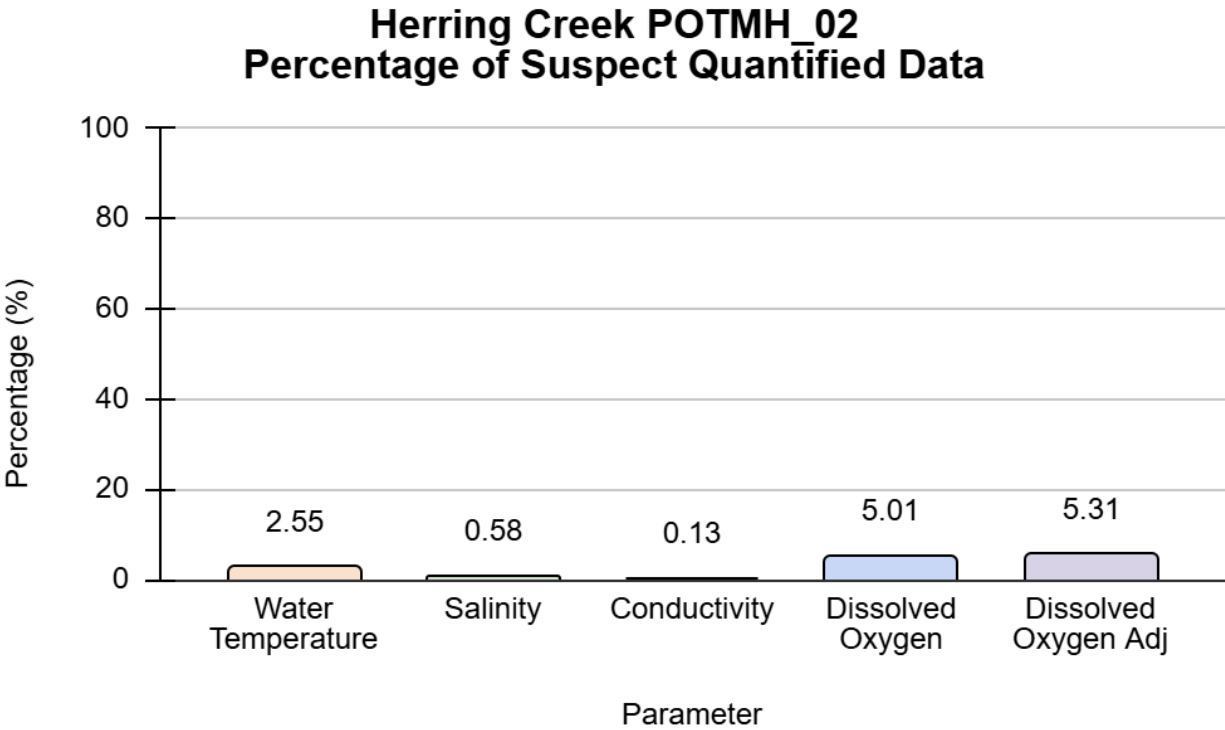
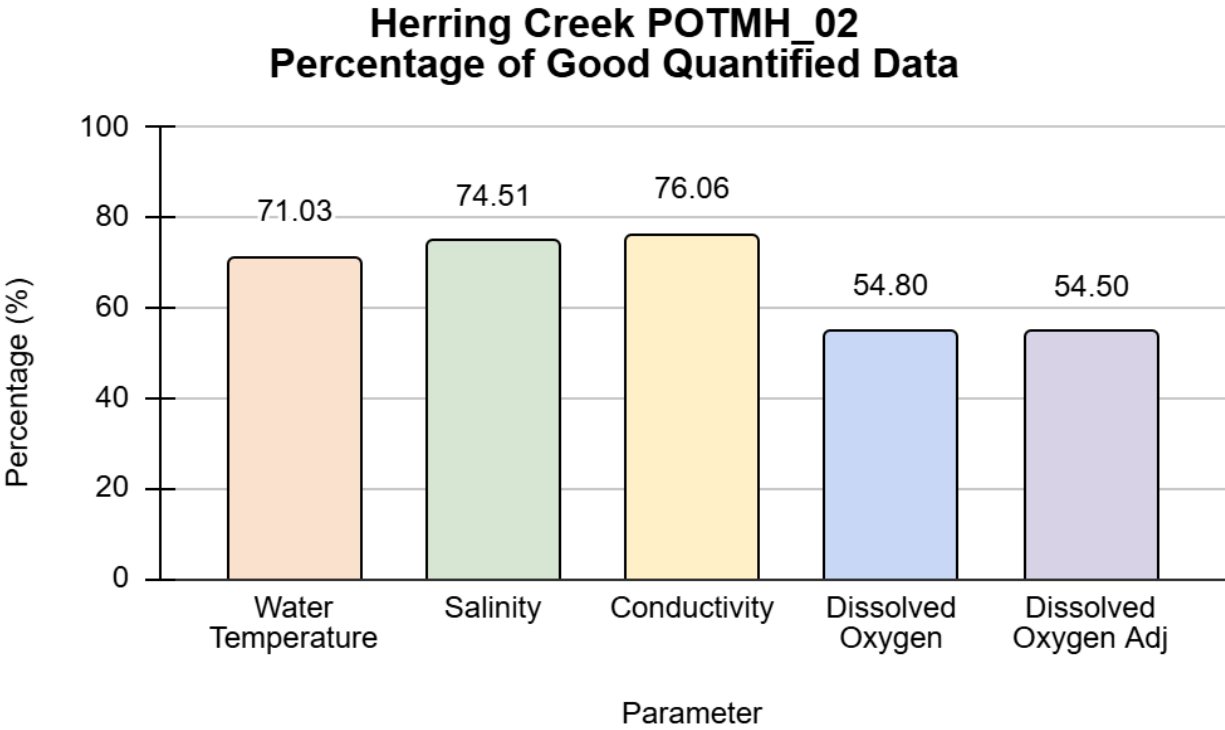
**Clements Island Tables**

Clements Island - Good Data	% of Quantified Data
Water Temperature	78.87
Salinity	62.56
Conductivity	92.83
Dissolved Oxygen	65.17
Dissolved Oxygen Adj	64.90
Clements Island - Suspect Data	% of Quantified Data
Water Temperature	4.65
Salinity	1.68
Conductivity	0.27
Dissolved Oxygen	5.15
Dissolved Oxygen Adj	5.42
Clements Island - Bad Data	% of Quantified Data
Water Temperature	13.39
Salinity	33.01
Conductivity	0.12
Dissolved Oxygen	24.78
Dissolved Oxygen Adj	24.78
Clements Island - Good + Suspect Data	% of Quantified Data
Water Temperature	83.52
Salinity	64.24
Conductivity	93.09
Dissolved Oxygen	70.32
Dissolved Oxygen Adj	70.32
Clements Island - Whole Station	% of Quantified Data
Good	72.87
Suspect	3.43
Bad	19.21
Good + Suspect	76.30

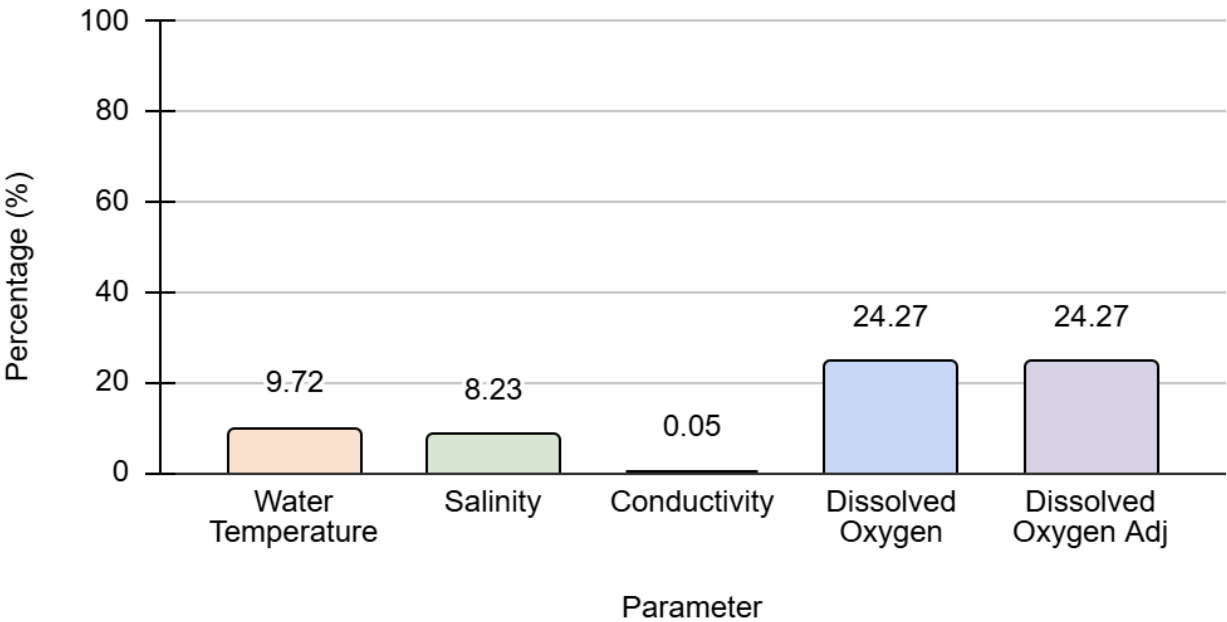
6.5 Herring Creek Metrics

Herring Creek Figures

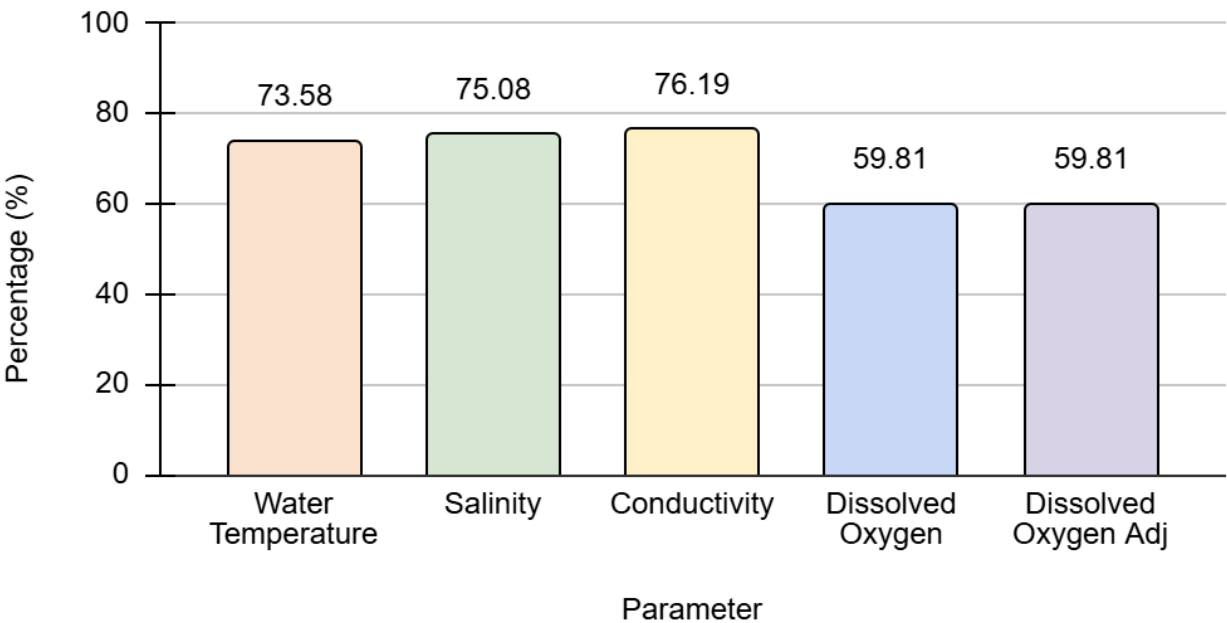




**Herring Creek POTMH\_02**  
**Percentage of Bad Quantified Data**



**Herring Creek POTMH\_02**  
**Percentage of Good + Suspect Quantified Data**

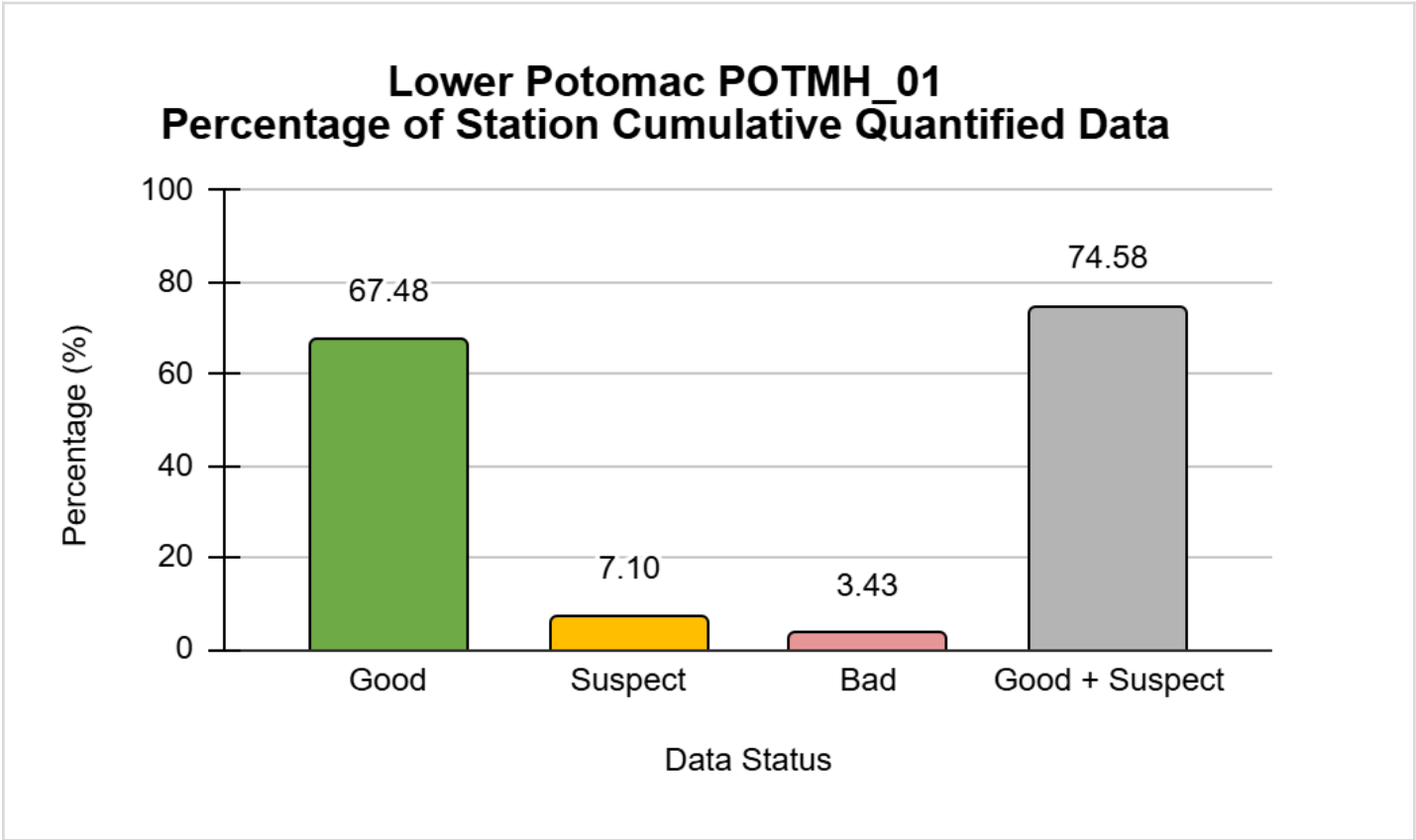


## Herring Creek Tables

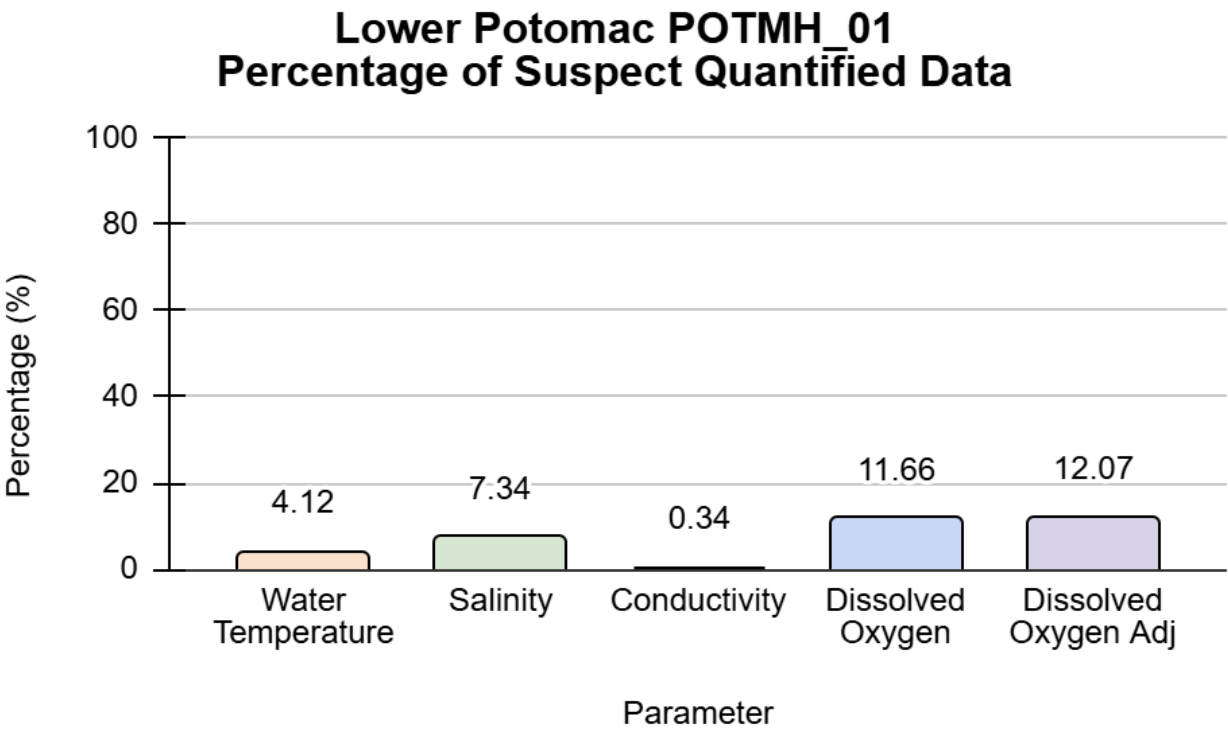
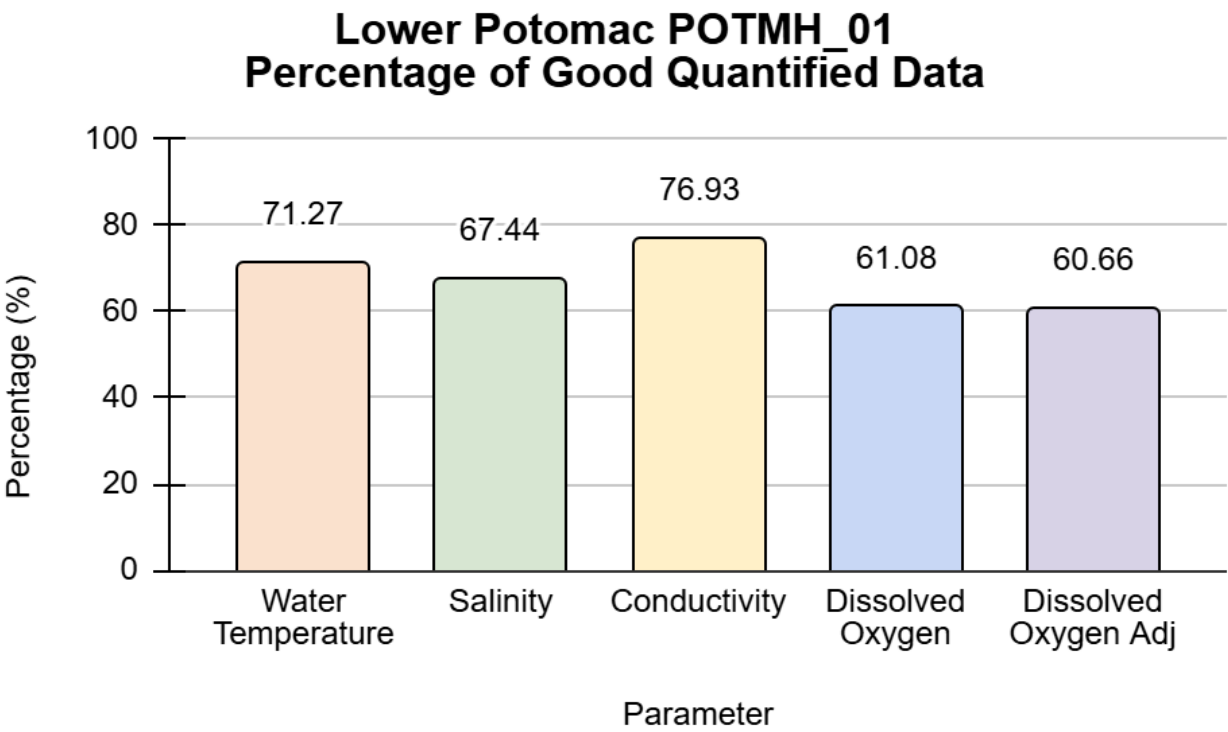
Herring Creek - Good Data	% of Quantified Data
Water Temperature	71.03
Salinity	74.51
Conductivity	76.06
Dissolved Oxygen	54.80
Dissolved Oxygen Adj	54.50
Herring Creek - Suspect Data	% of Quantified Data
Water Temperature	2.55
Salinity	0.58
Conductivity	0.13
Dissolved Oxygen	5.01
Dissolved Oxygen Adj	5.31
Herring Creek - Bad Data	% of Quantified Data
Water Temperature	9.72
Salinity	8.23
Conductivity	0.05
Dissolved Oxygen	24.27
Dissolved Oxygen Adj	24.27
Herring Creek - Good + Suspect Data	% of Quantified Data
Water Temperature	73.58
Salinity	75.08
Conductivity	76.19
Dissolved Oxygen	59.81
Dissolved Oxygen Adj	59.81
Herring Creek - Whole Station	% of Quantified Data
Good	66.18
Suspect	2.71
Bad	13.31
Good + Suspect	68.89

6.6. Lower Potomac Metrics

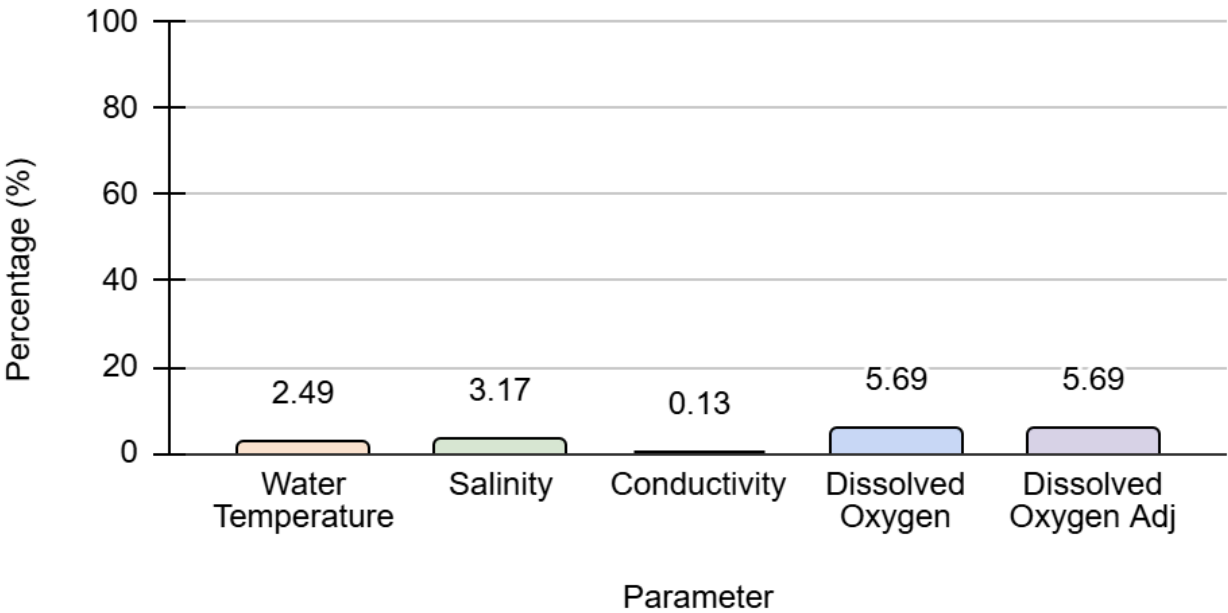
Lower Potomac Figures



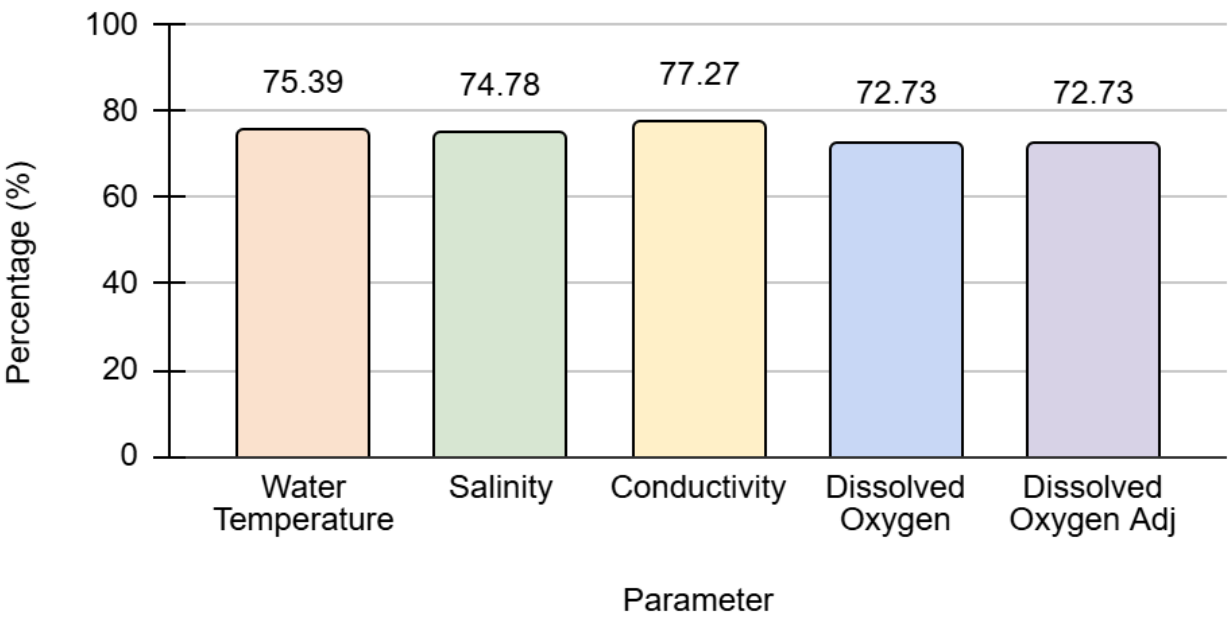




**Lower Potomac POTMH\_01  
Percentage of Bad Quantified Data**



**Lower Potomac POTMH\_01  
Percentage of Good + Suspect Quantified Data**



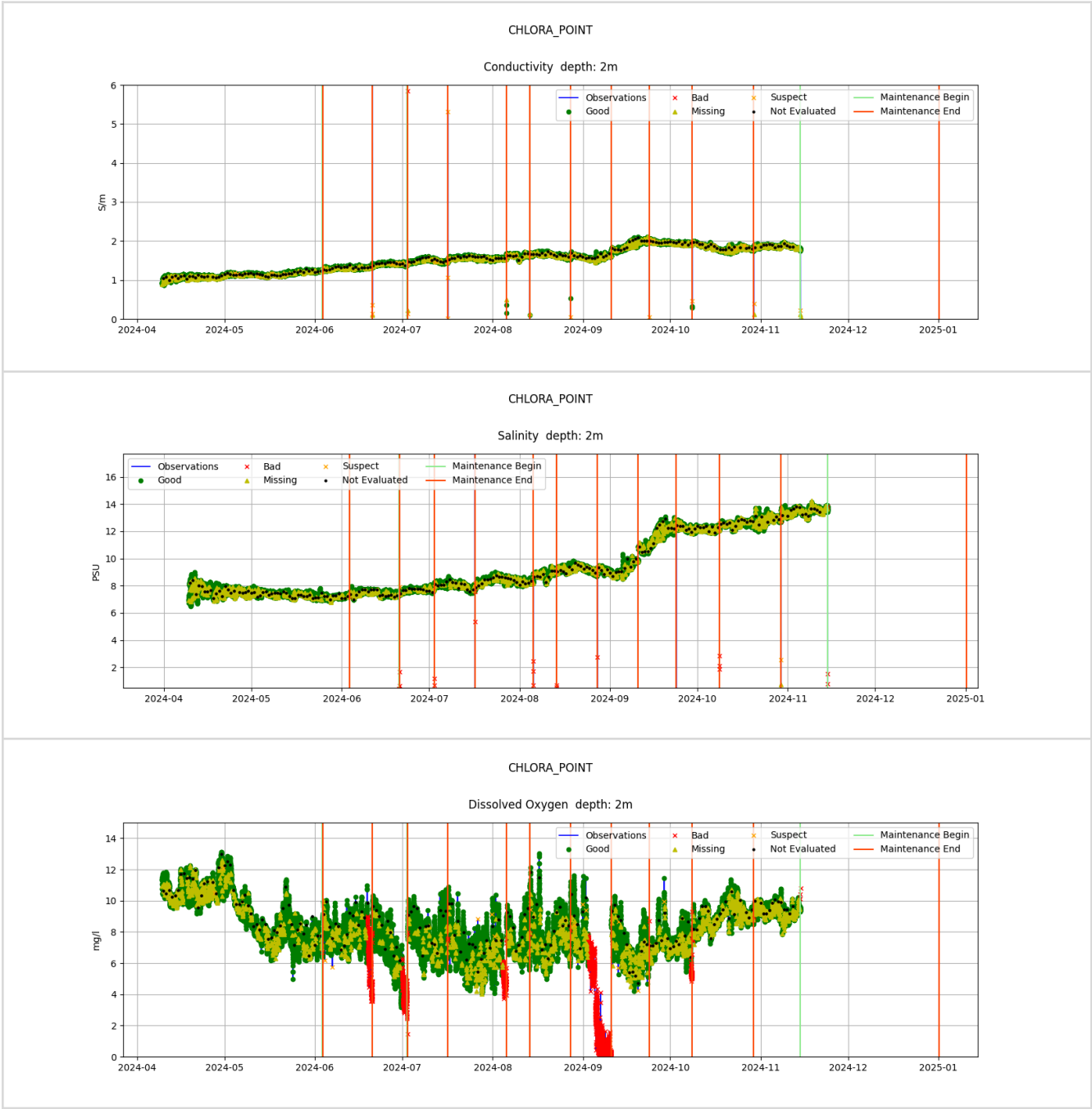
## Lower Potomac Tables

Lower Potomac - Good Data	% of Quantified Data
Water Temperature	71.27
Salinity	67.44
Conductivity	76.93
Dissolved Oxygen	61.08
Dissolved Oxygen Adj	60.66
Lower Potomac - Suspect Data	% of Quantified Data
Water Temperature	4.12
Salinity	7.34
Conductivity	0.34
Dissolved Oxygen	11.66
Dissolved Oxygen Adj	12.07
Lower Potomac - Bad Data	% of Quantified Data
Water Temperature	2.49
Salinity	3.17
Conductivity	0.13
Dissolved Oxygen	5.69
Dissolved Oxygen Adj	5.69
Lower Potomac - Good + Suspect Data	% of Quantified Data
Water Temperature	73.58
Salinity	75.08
Conductivity	76.19
Dissolved Oxygen	59.81
Dissolved Oxygen Adj	59.81
Lower Potomac - Whole Station	% of Quantified Data
Good	66.18
Suspect	2.71
Bad	13.31
Good + Suspect	68.89

# 7. Yearly Plots

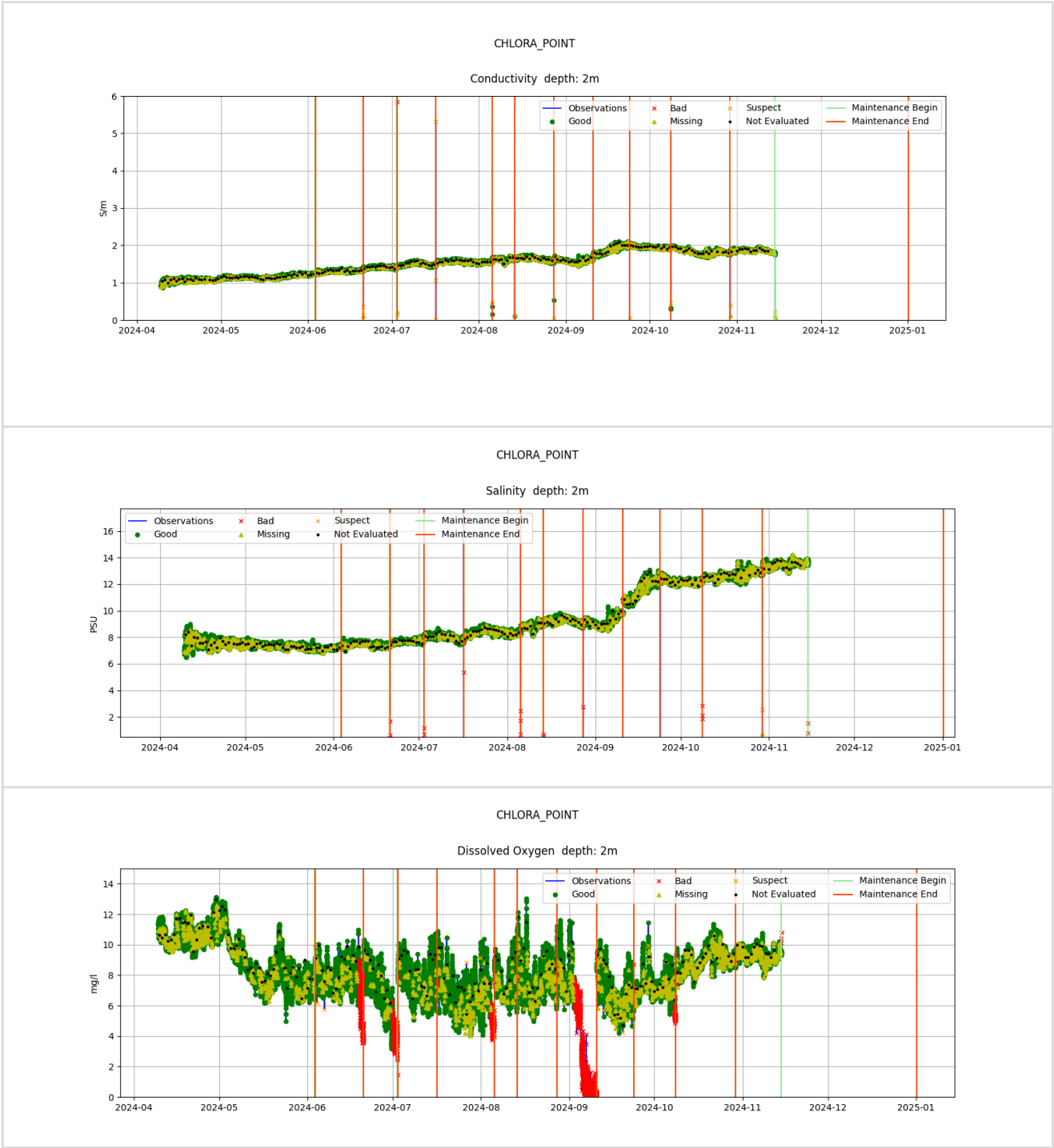
## 7.1 Chlora Point

### Chlora Point 2m

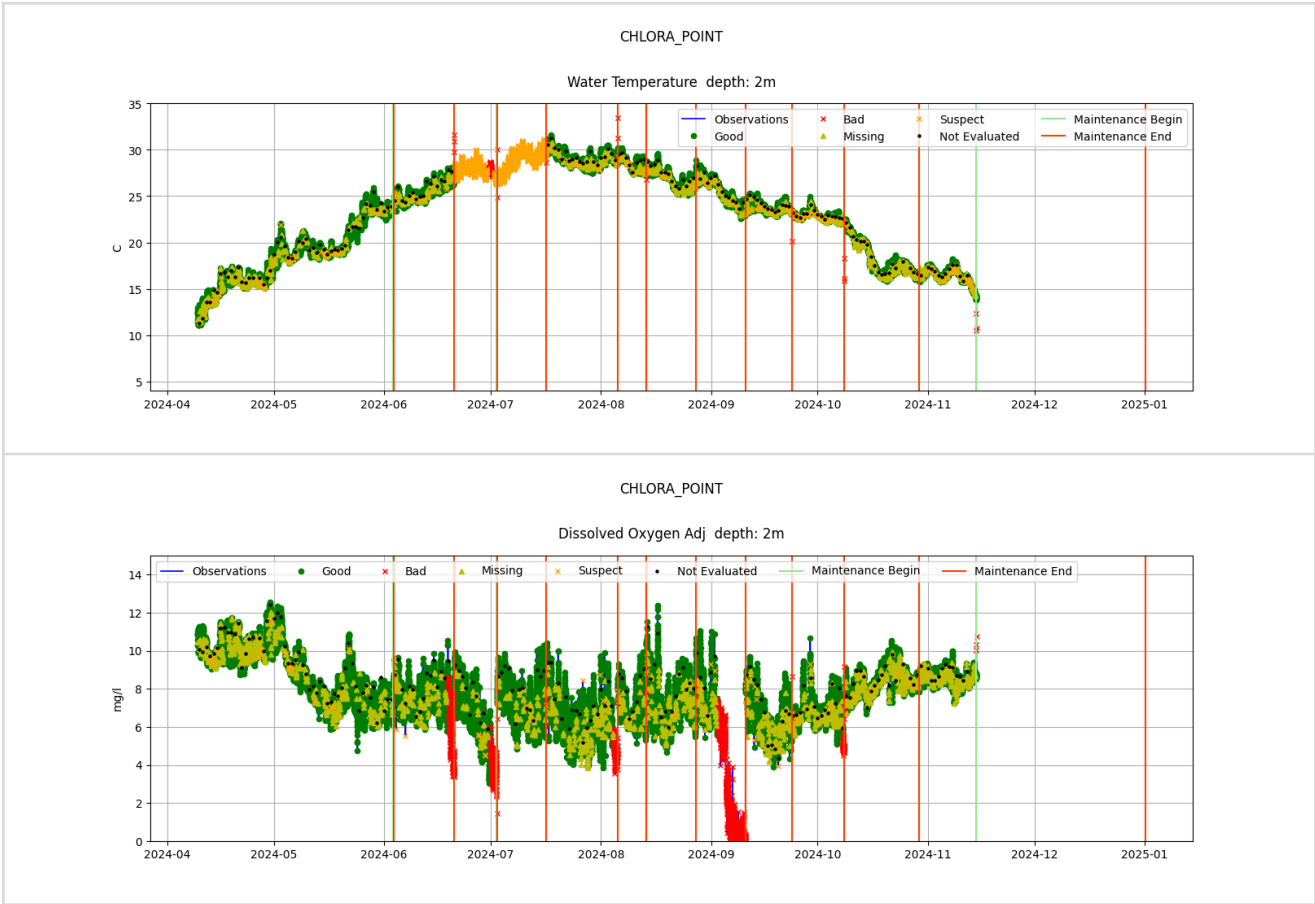




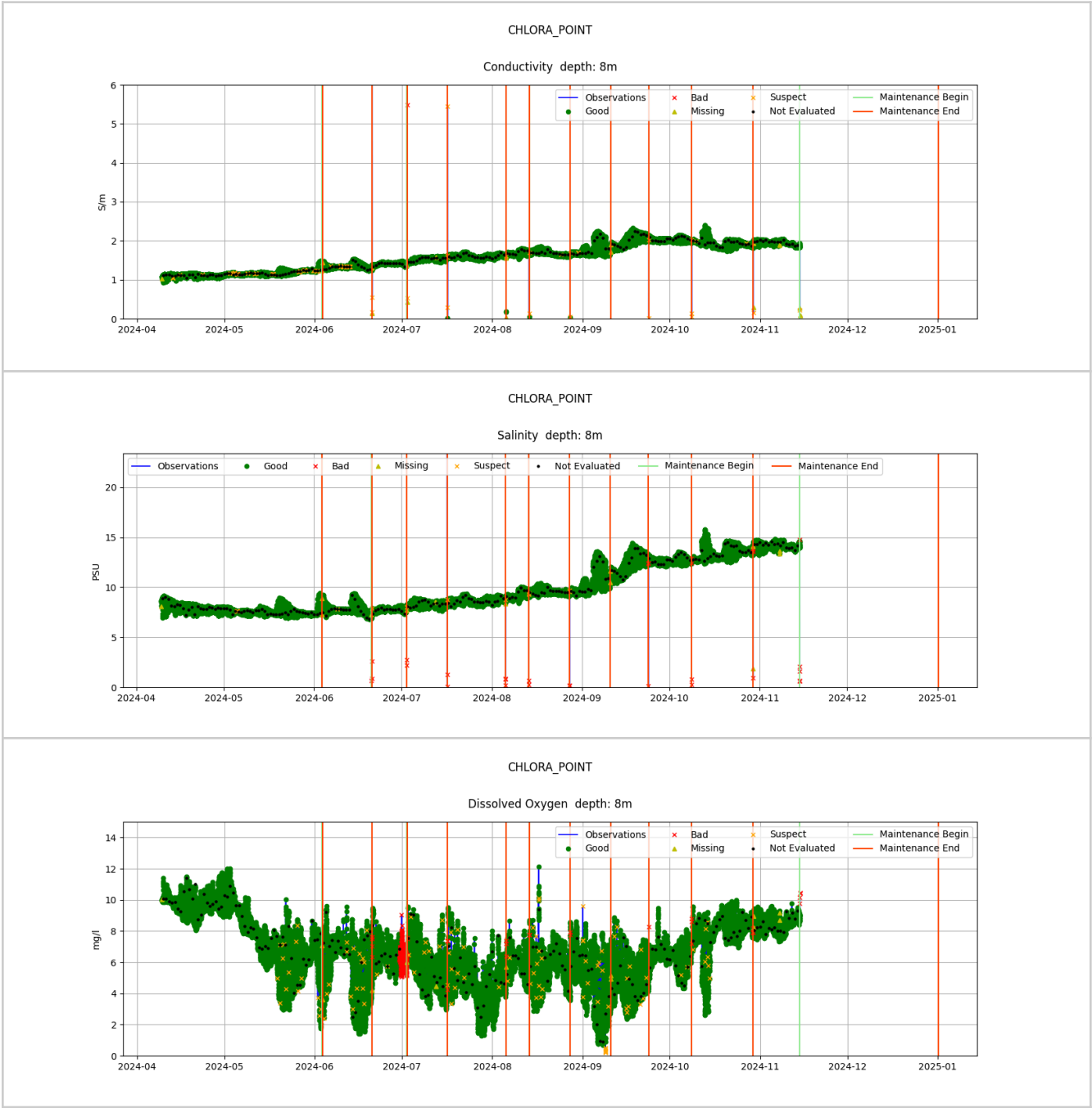
Chlora Point 5m

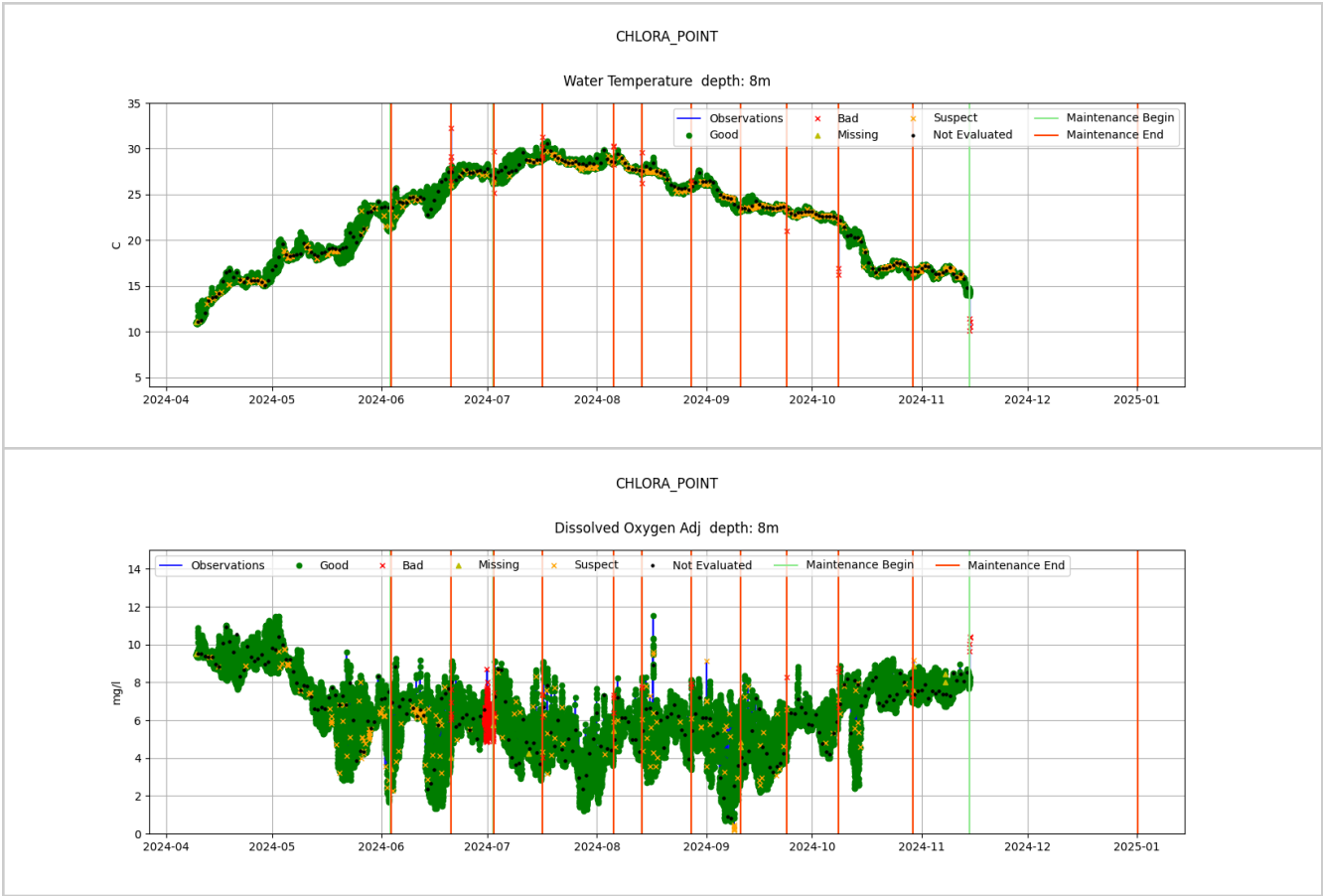






Chlora Point 8m





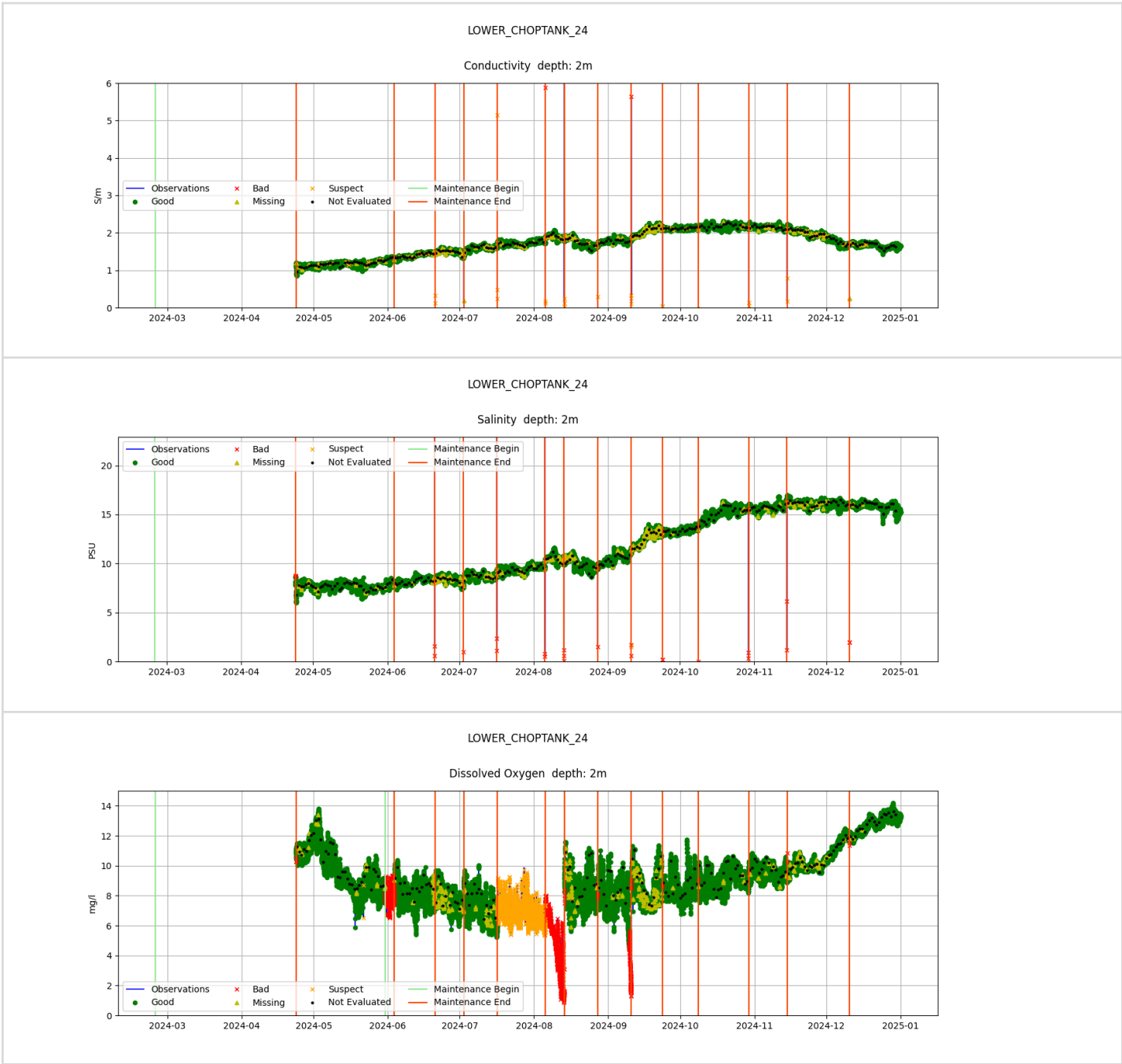
## 7.2 Lower Choptank

### Lower Choptank 1m





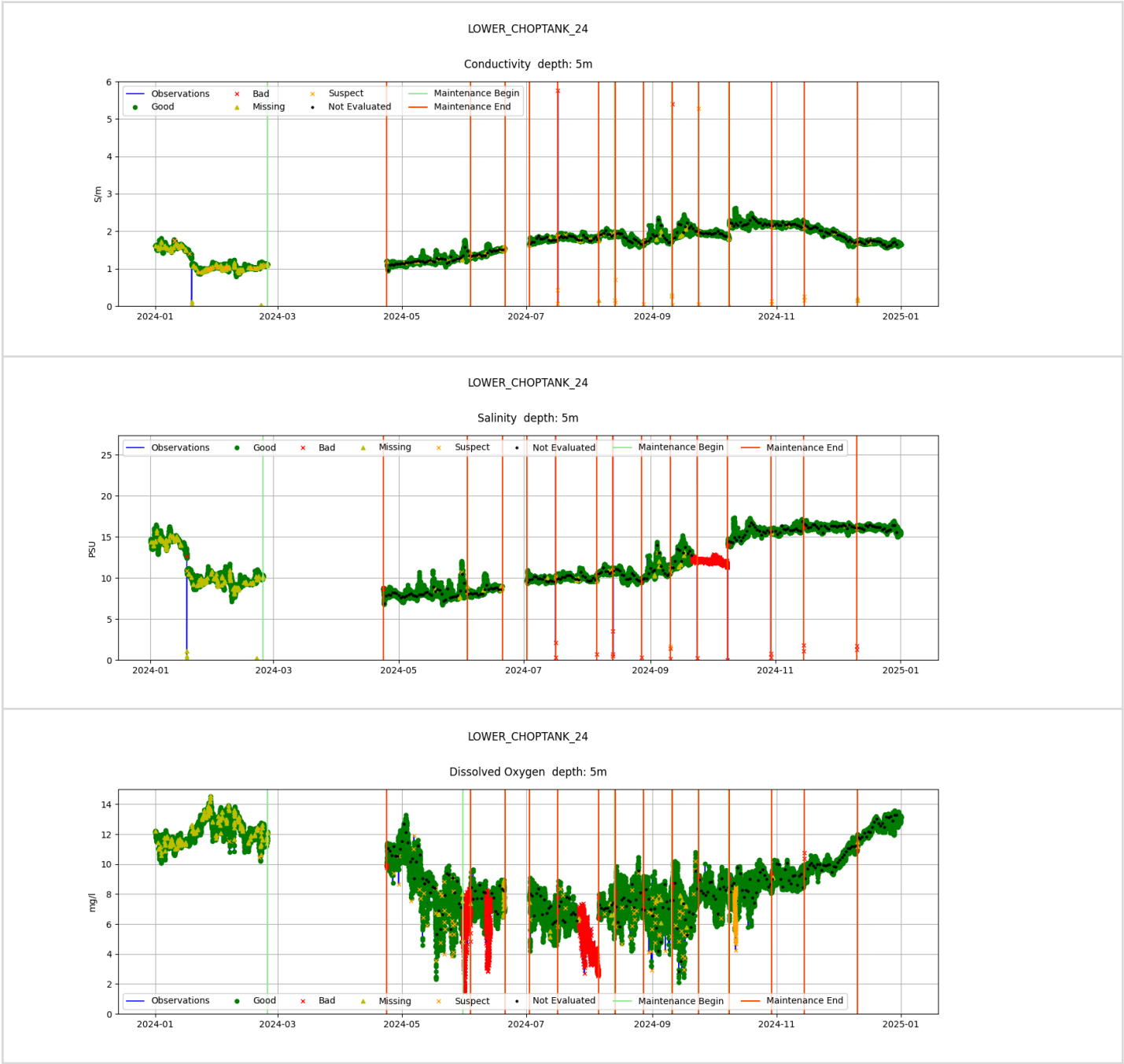
Lower Choptank 2m





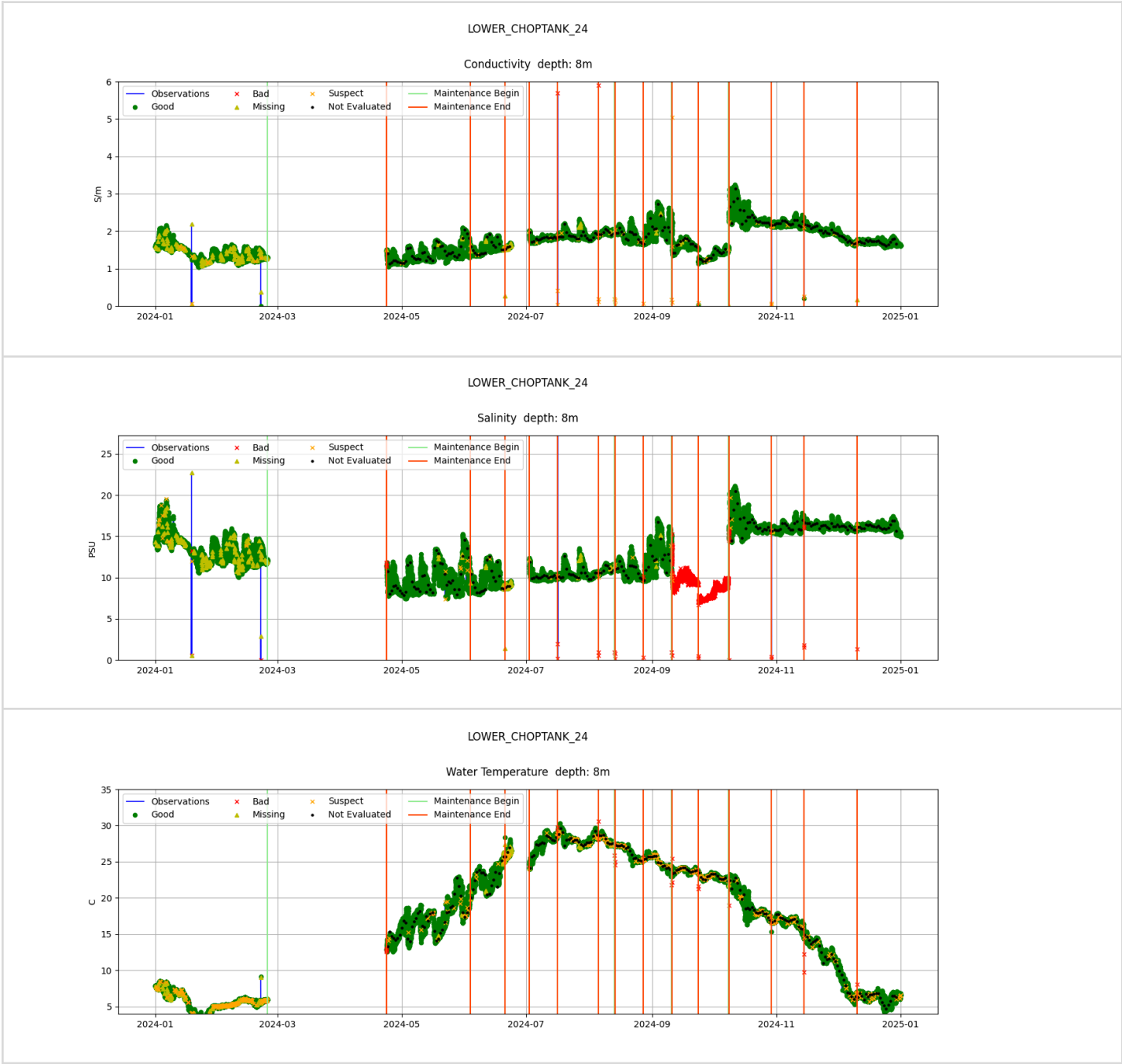


Lower Choptank 5m





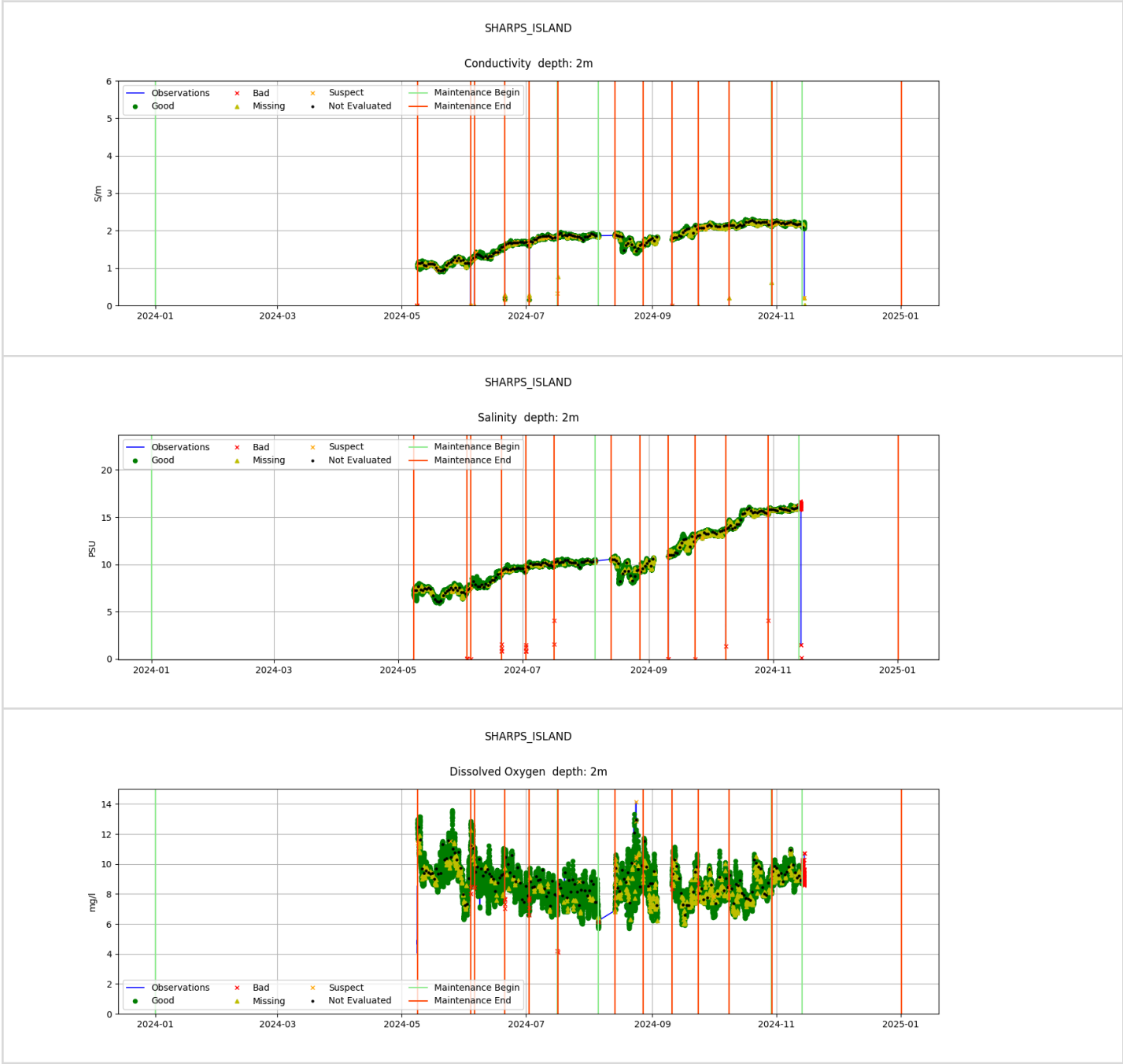
Lower Choptank 8m



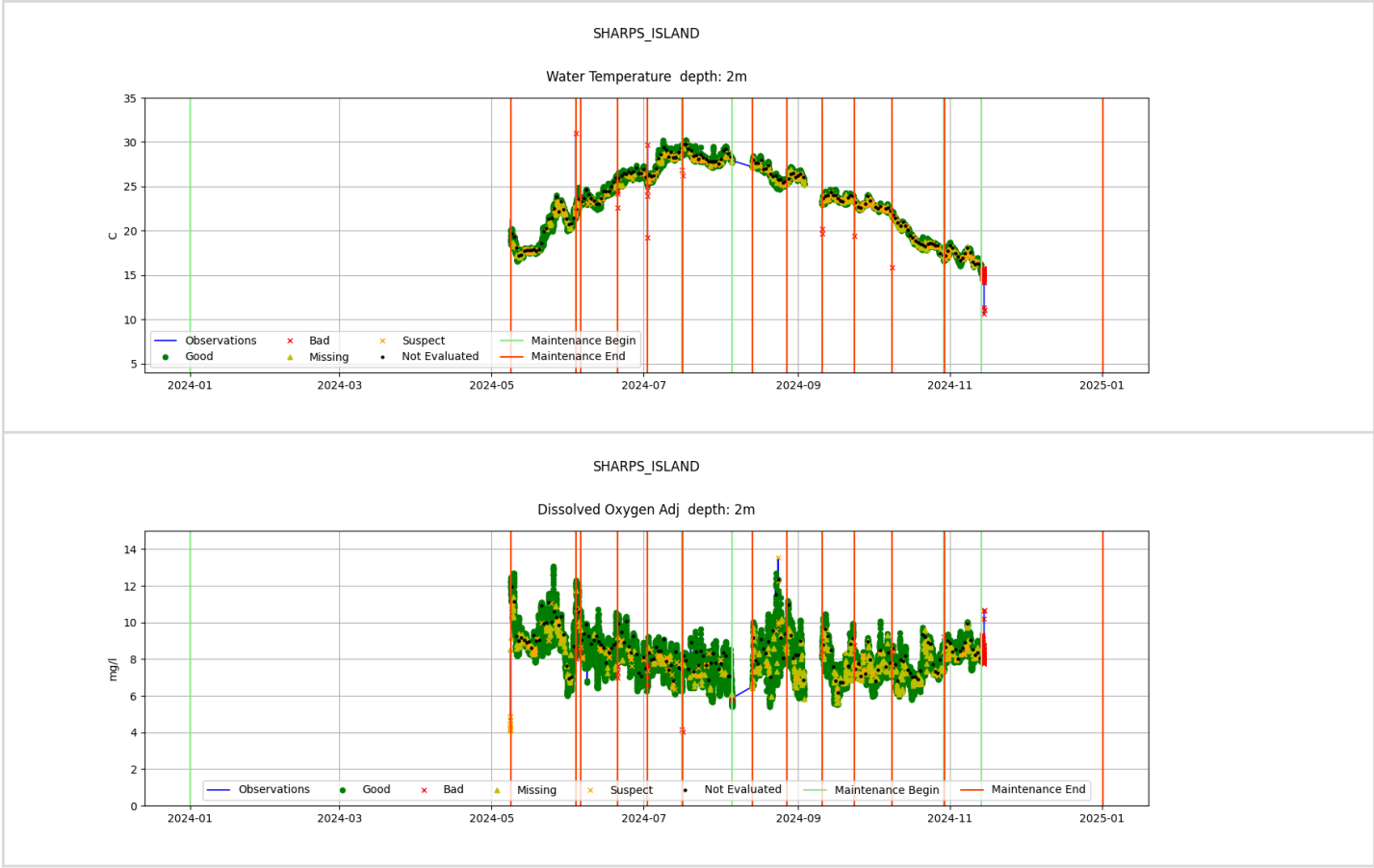


### 7.3 Sharps Island

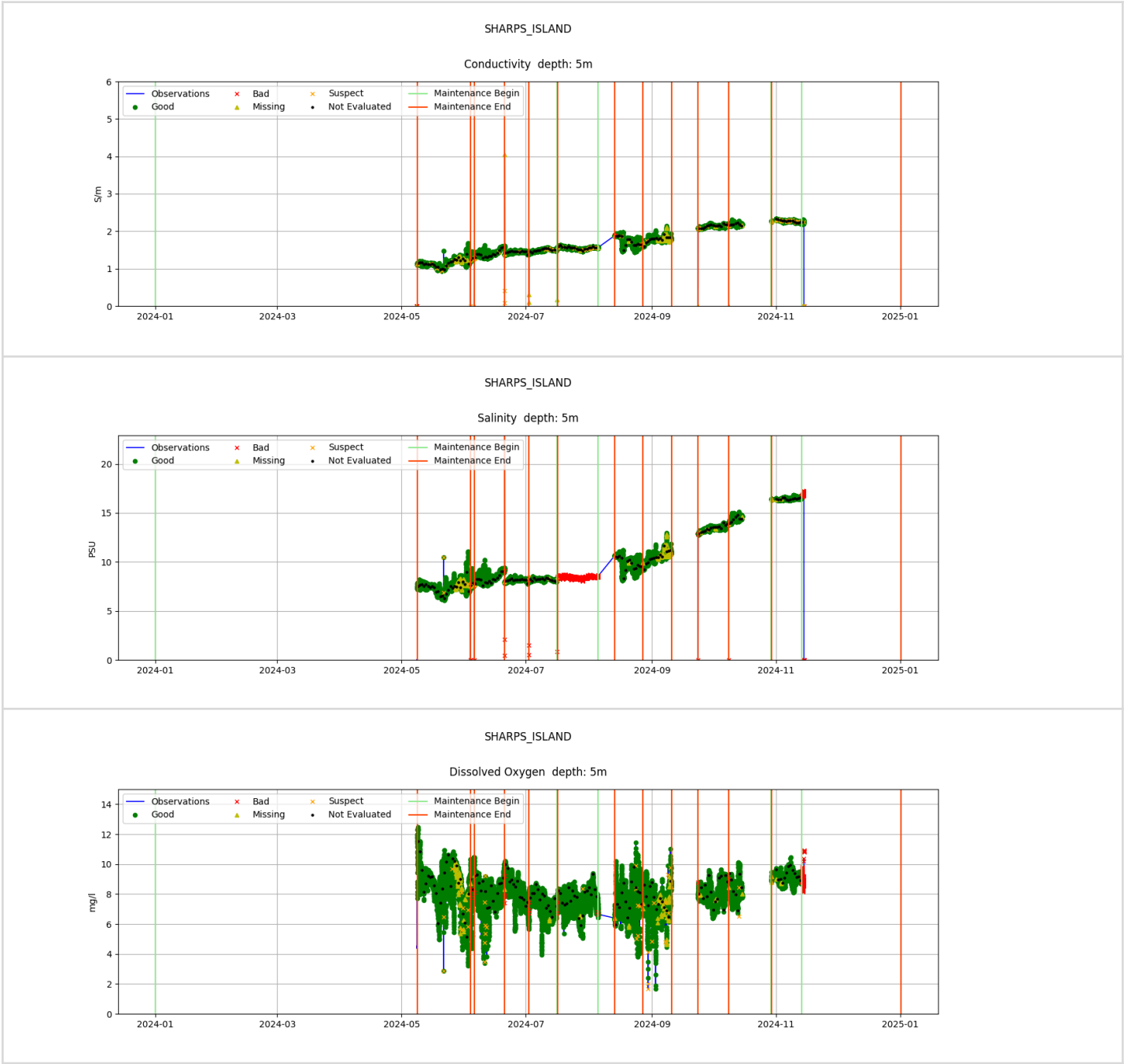
#### Sharps Island 2m

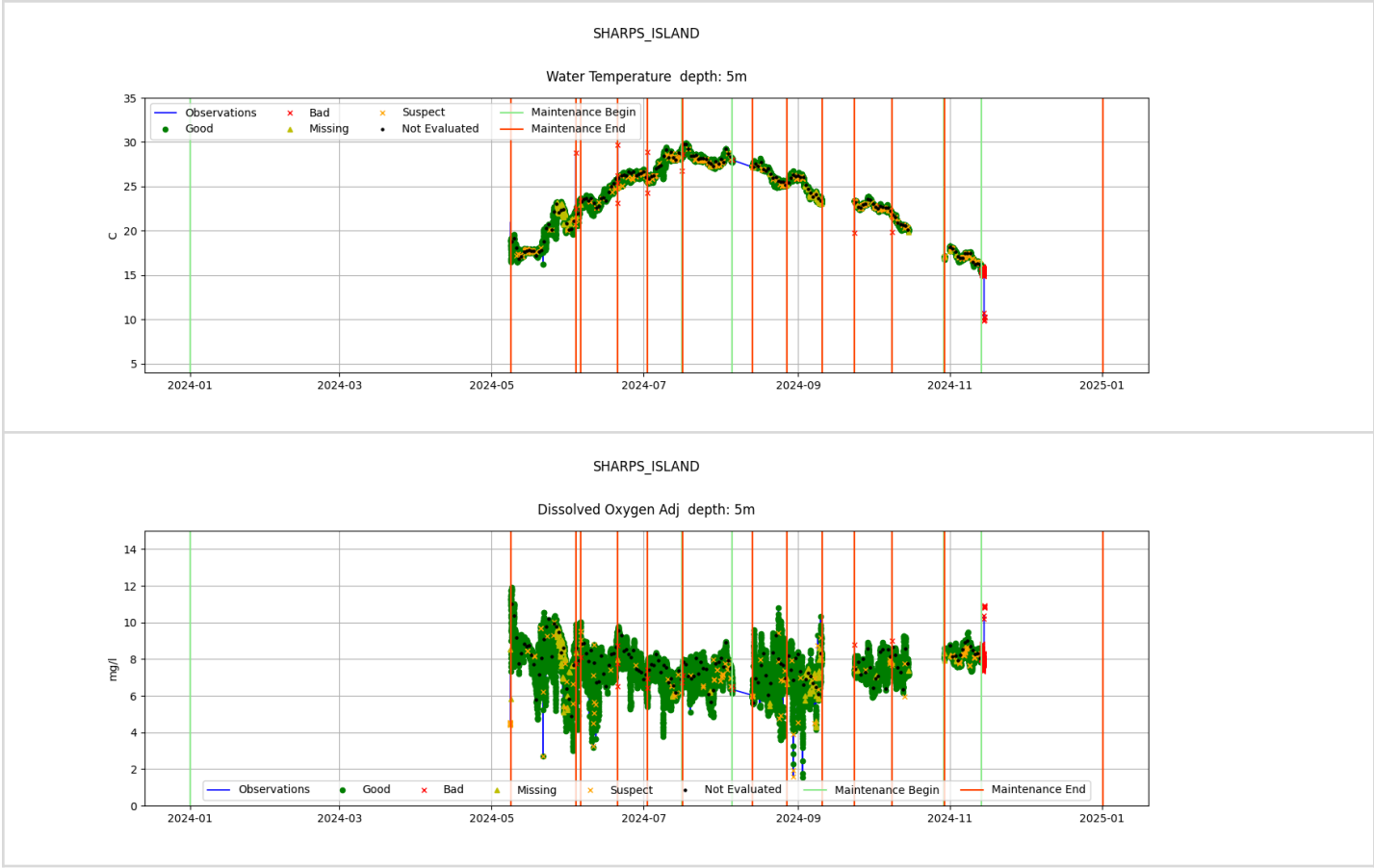




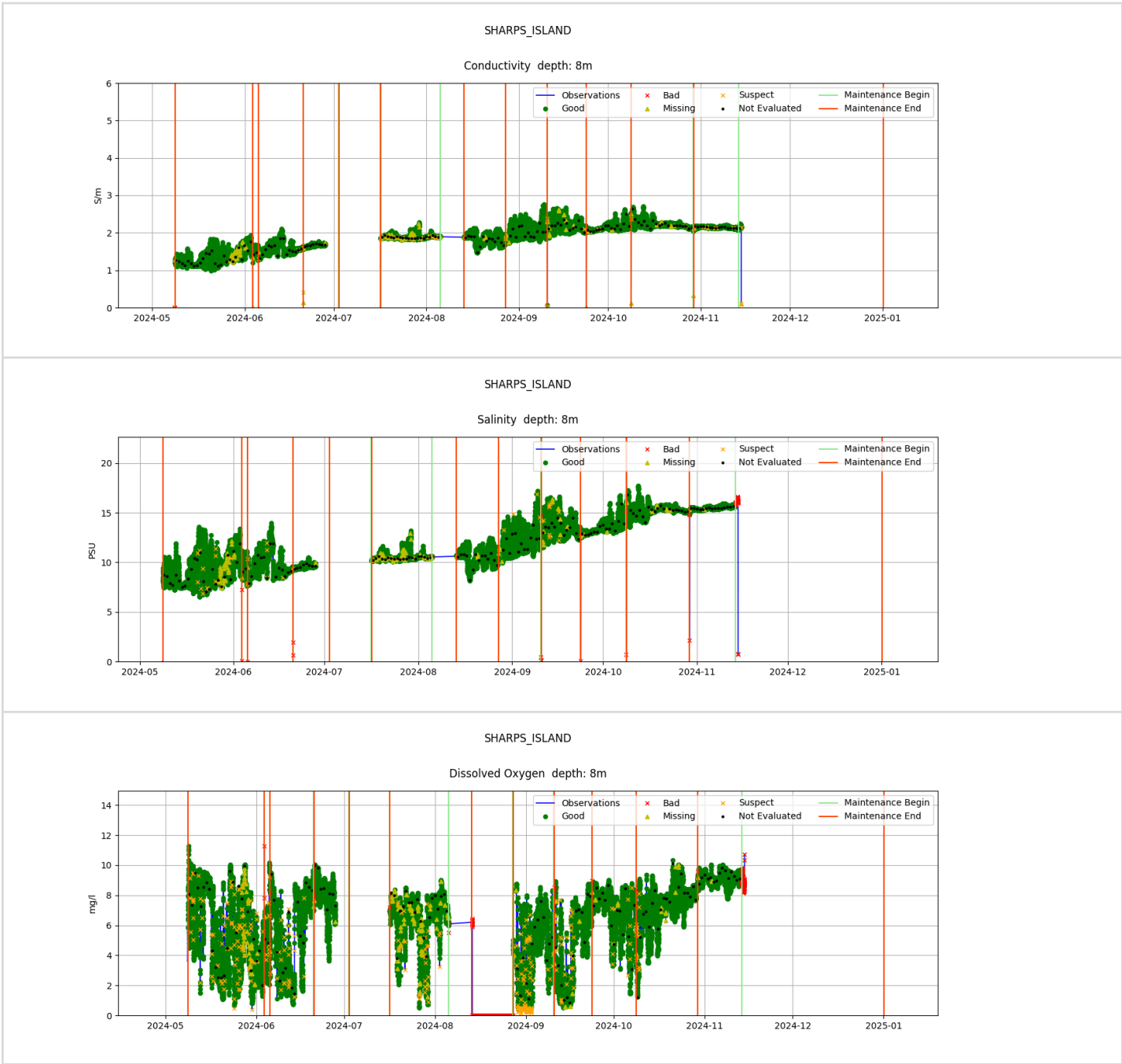


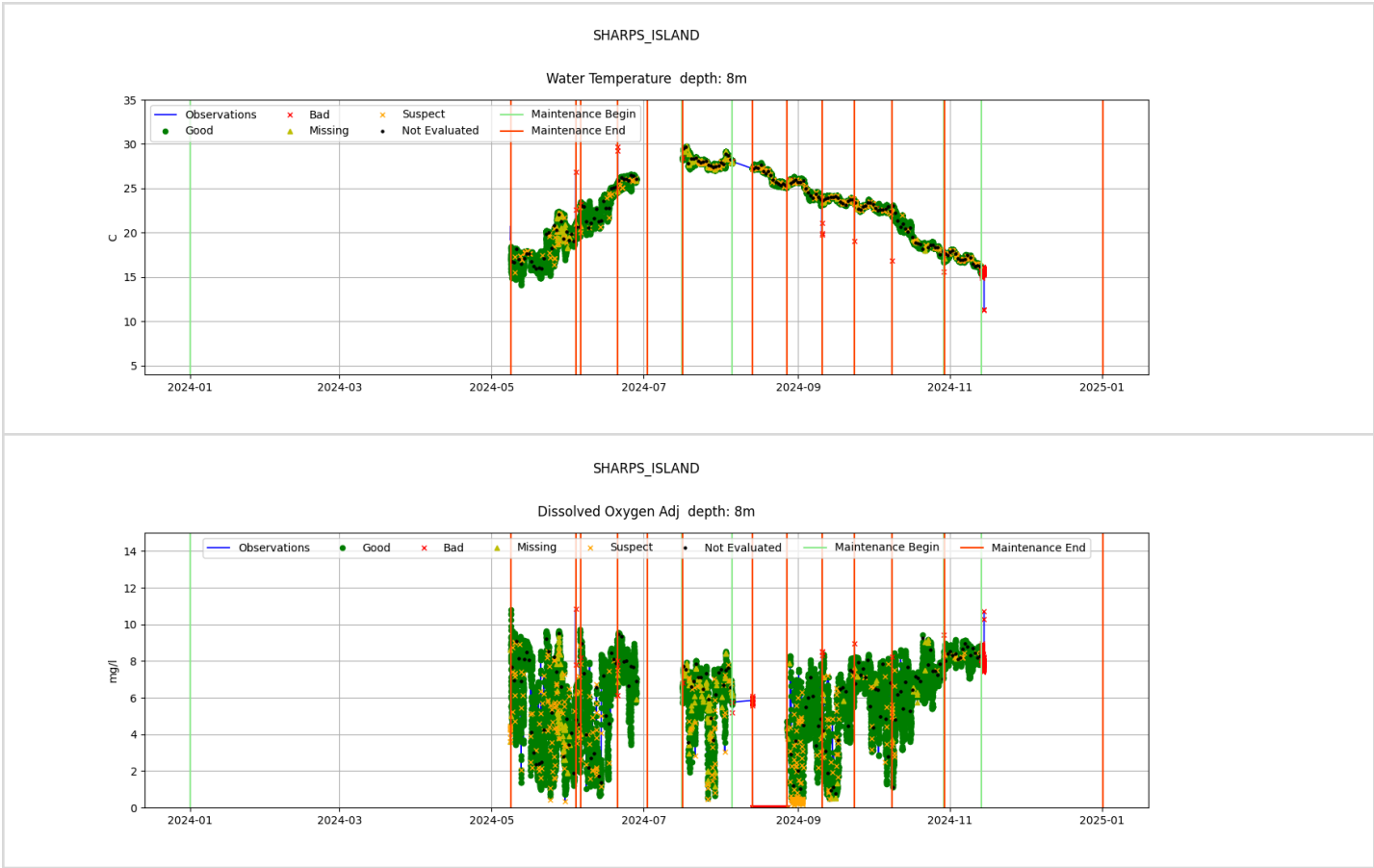
Sharps Island 5m



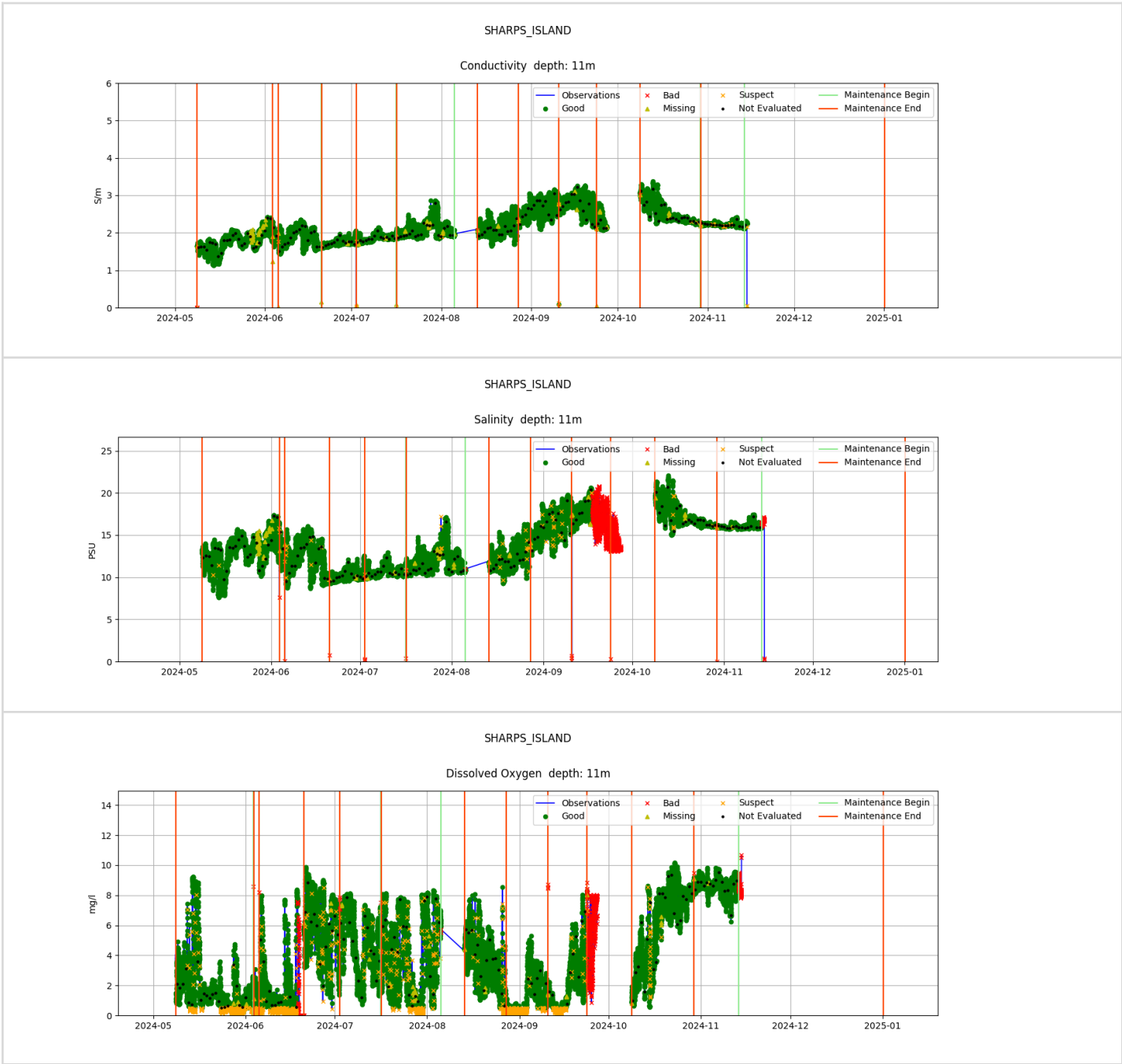


Sharps Island 8m





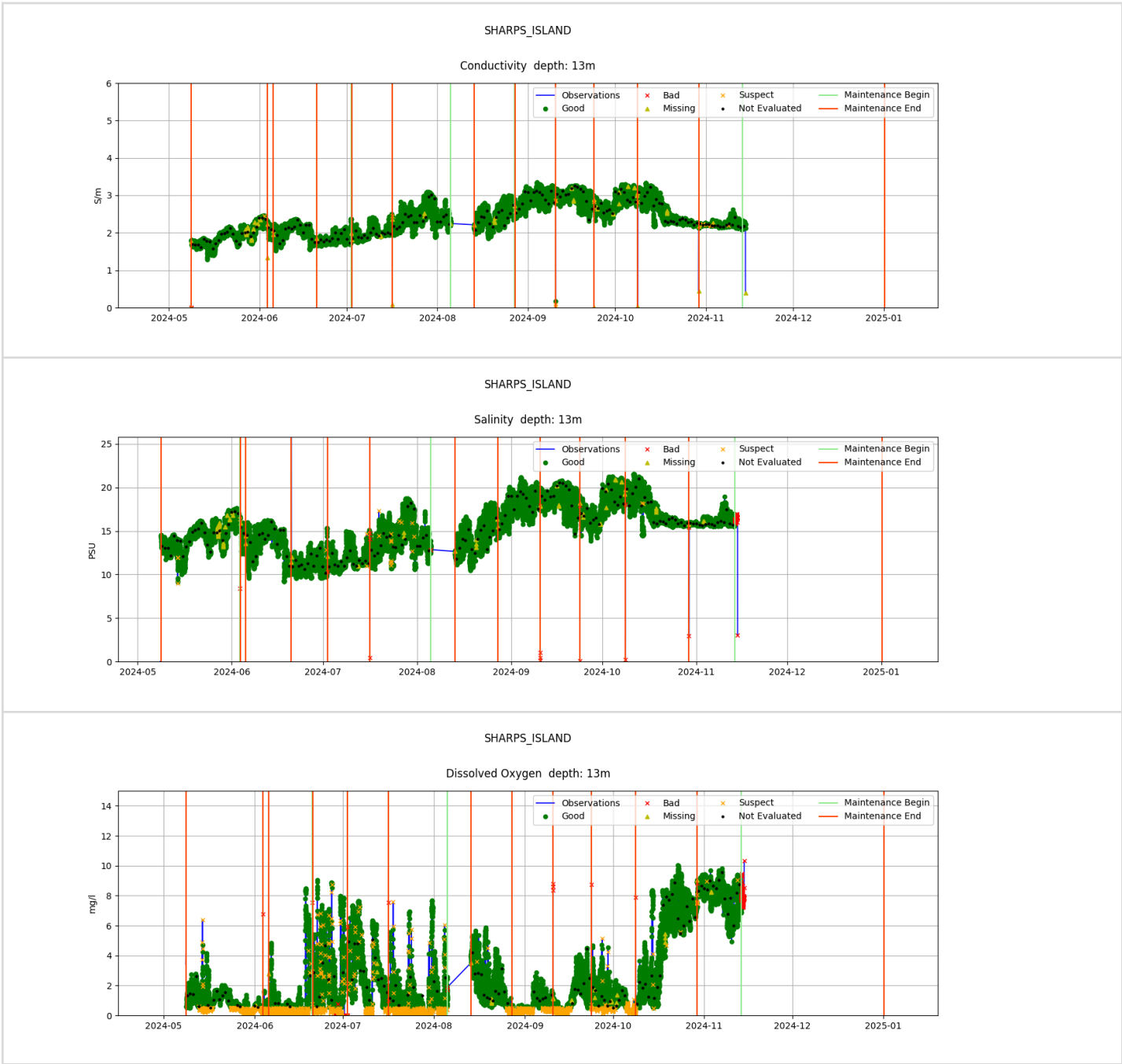
Sharps Island 11m





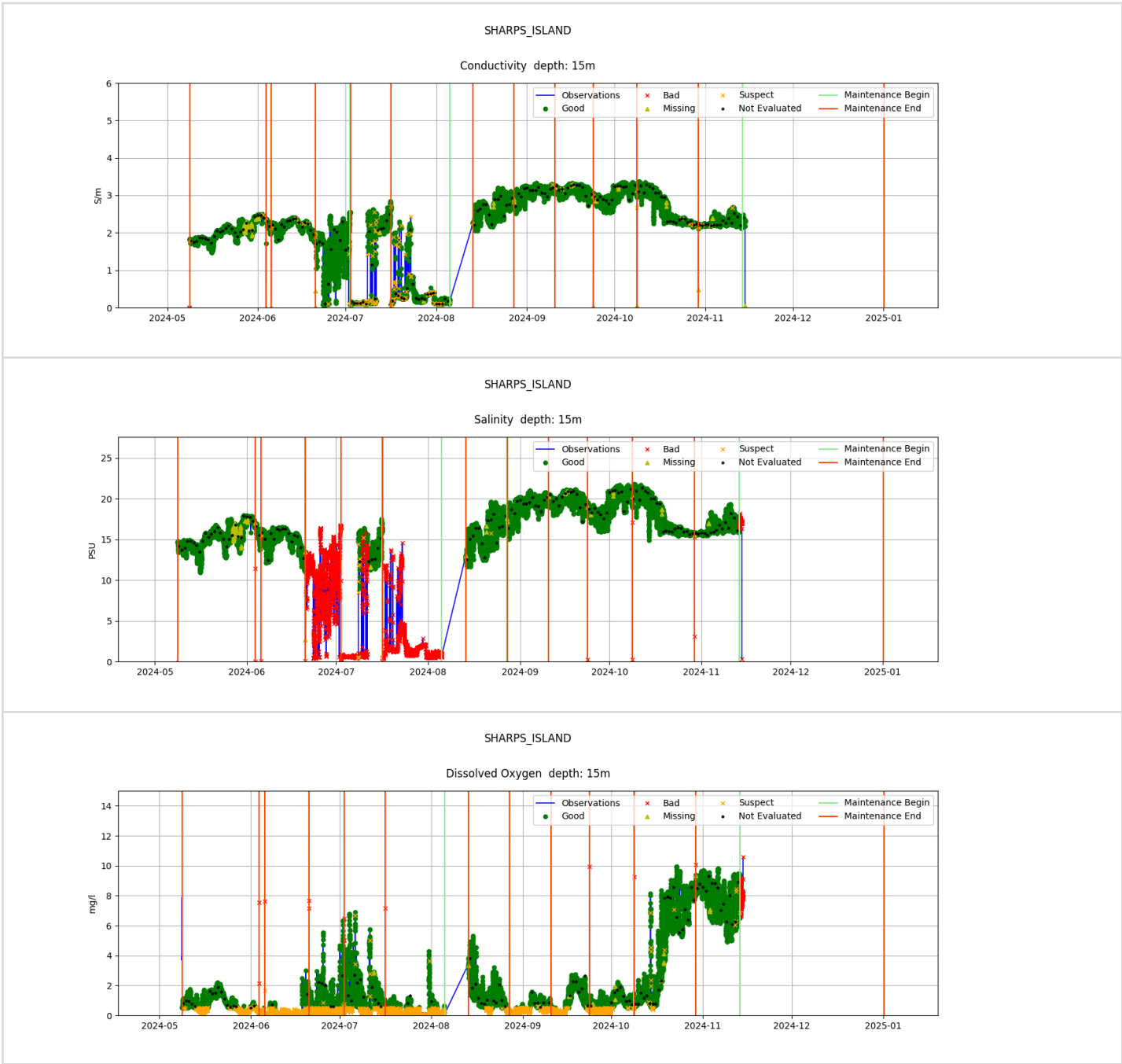


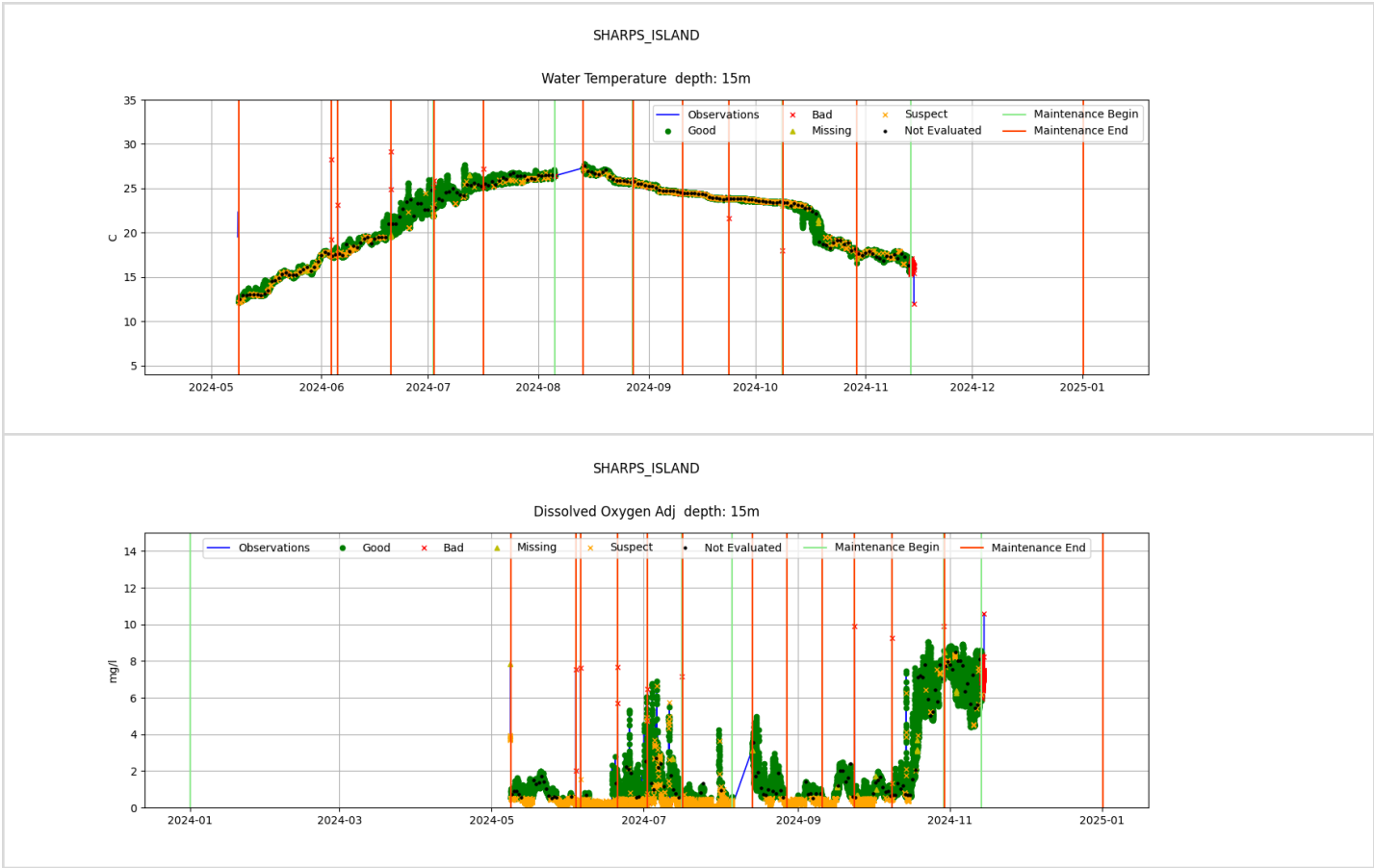
Sharps Island 13m





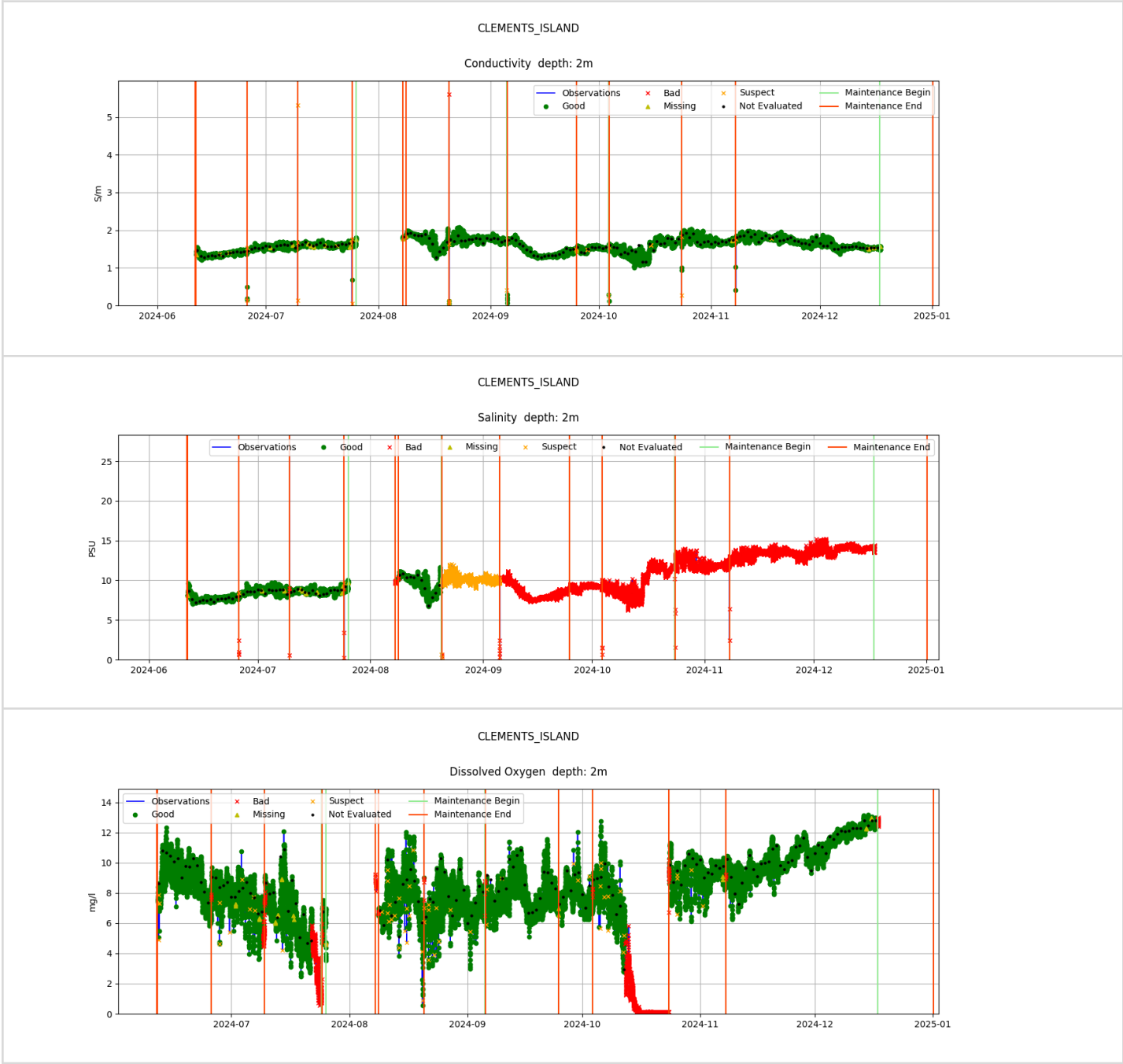
Sharps Island 15m

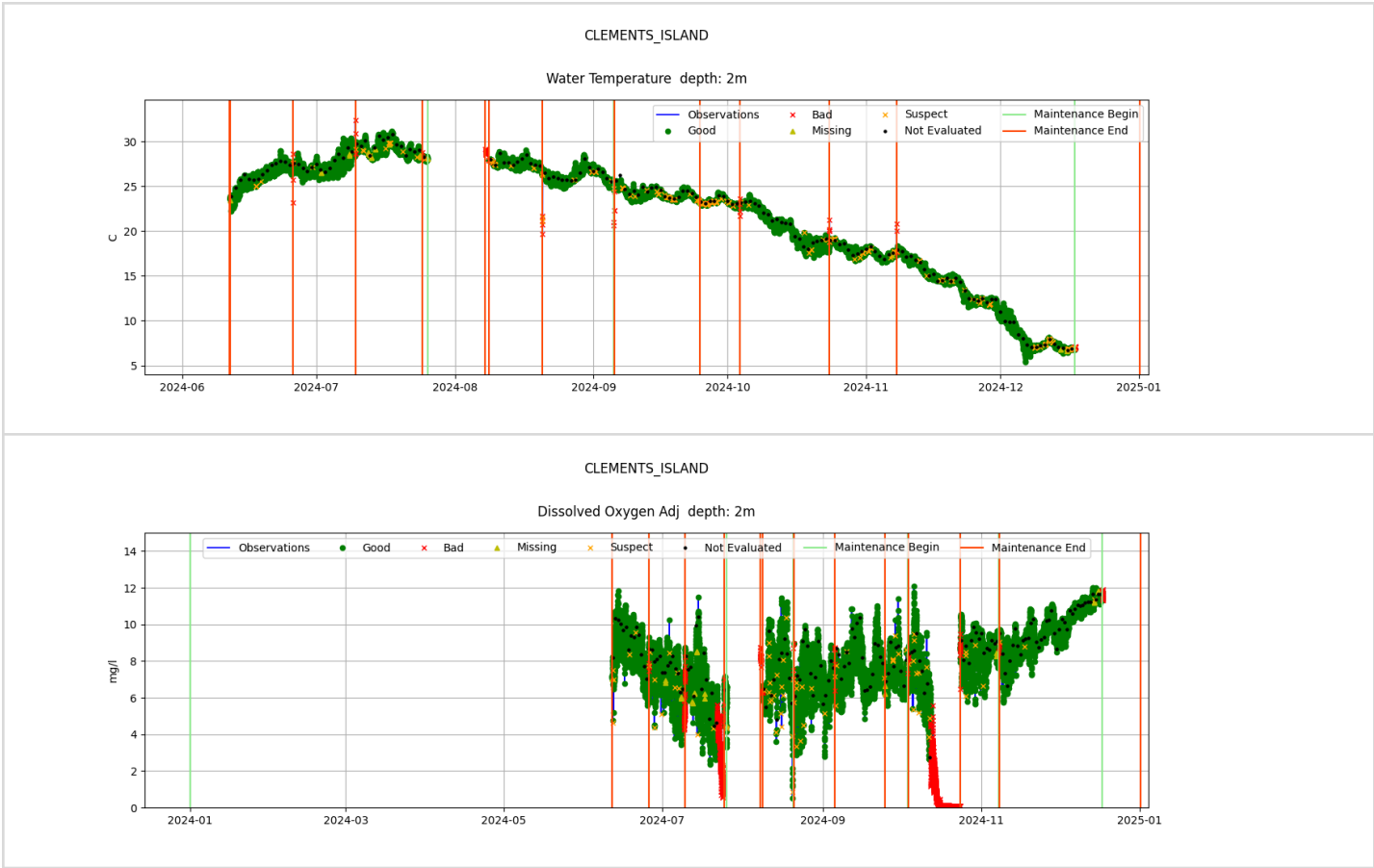




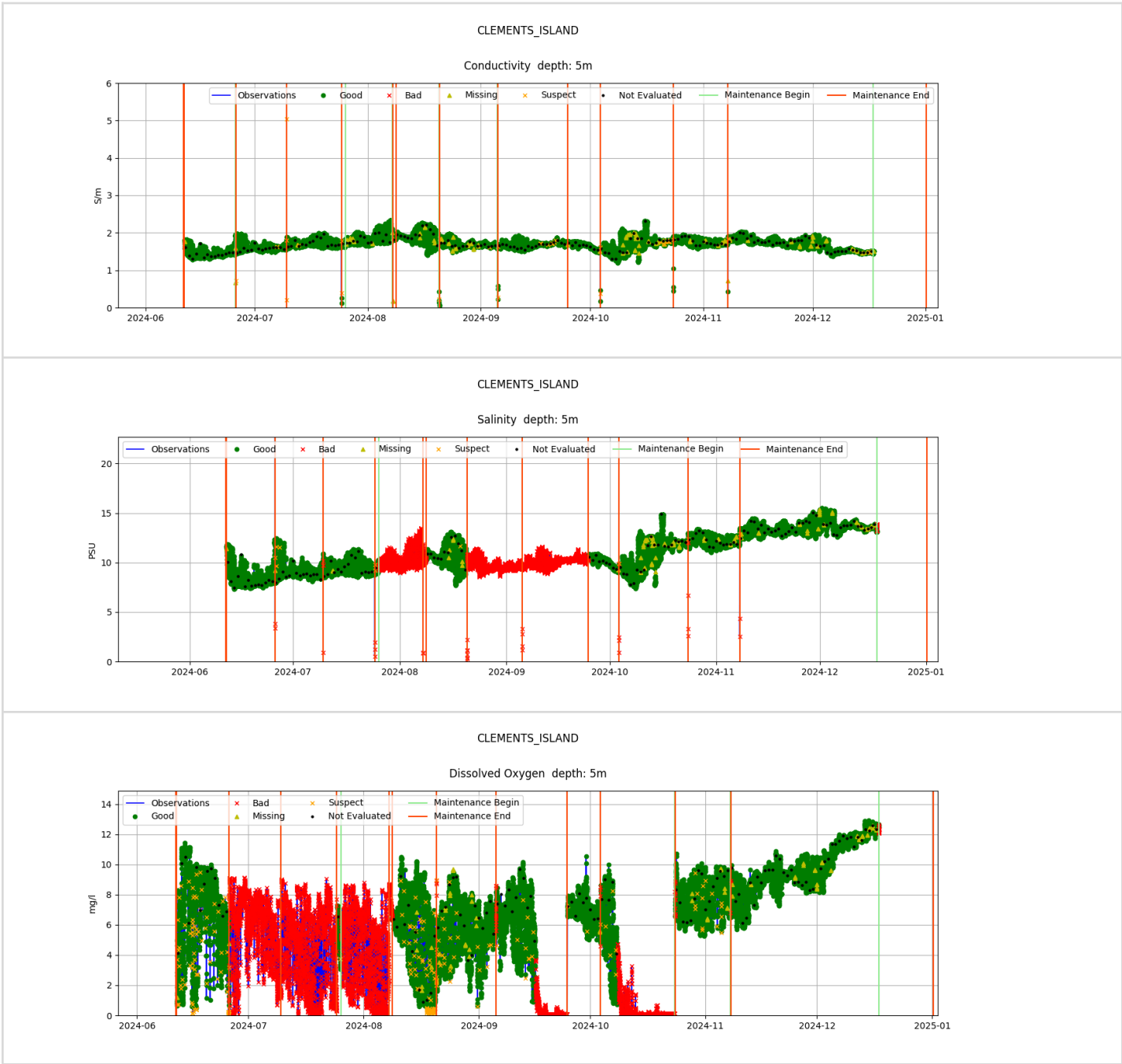
## 7.4 Clements Island

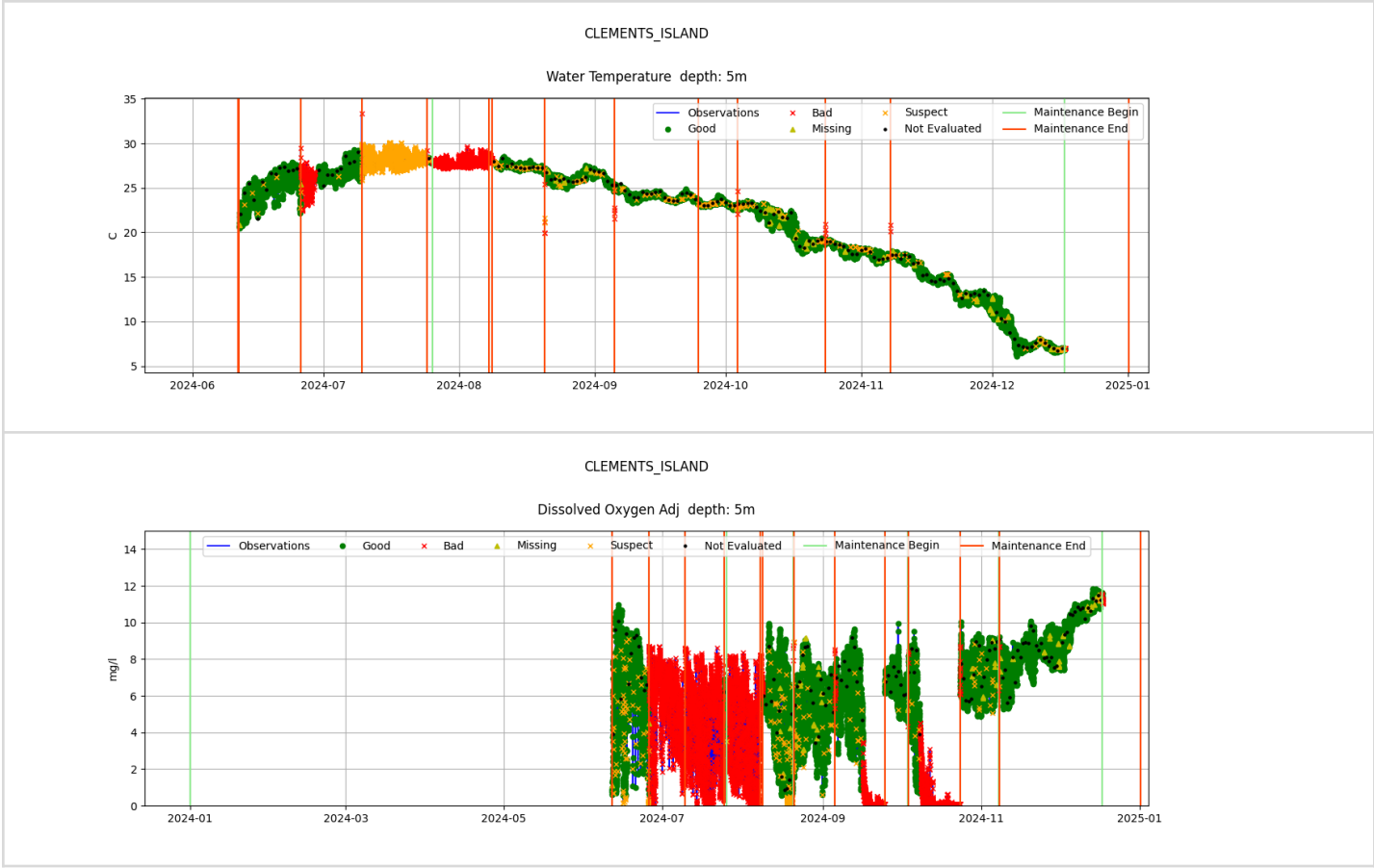
### Clements Island 2m





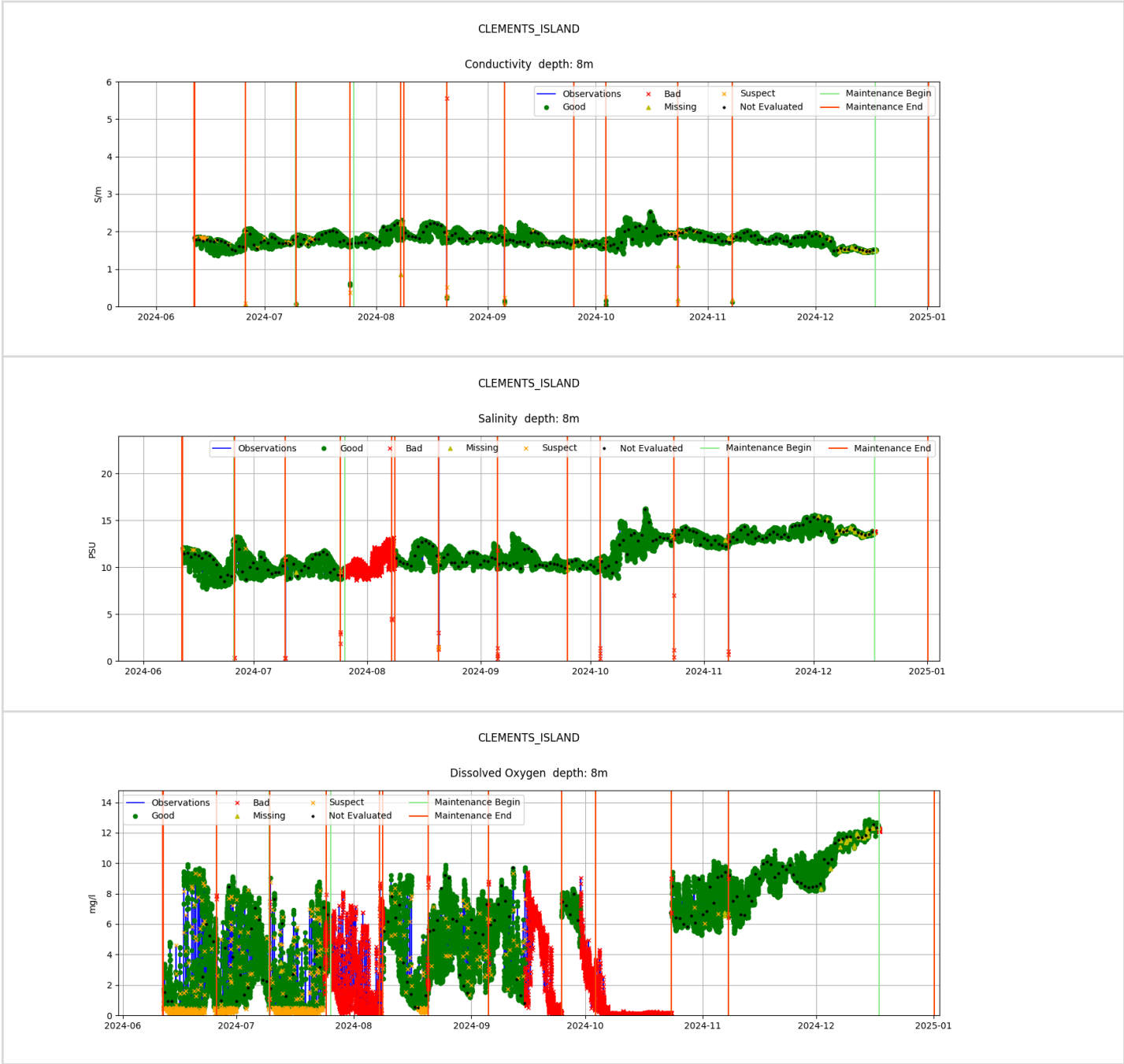
Clements Island 5m

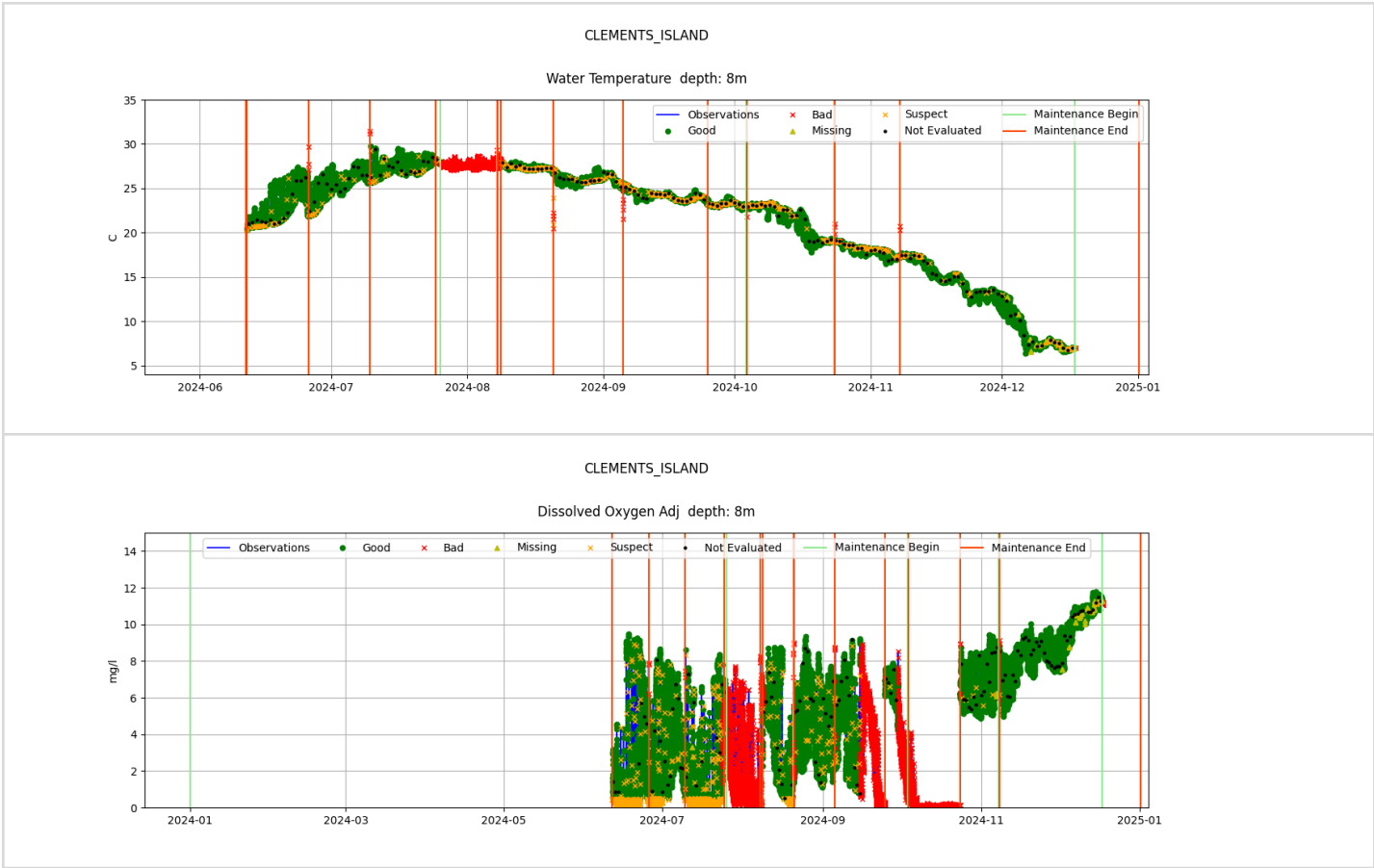




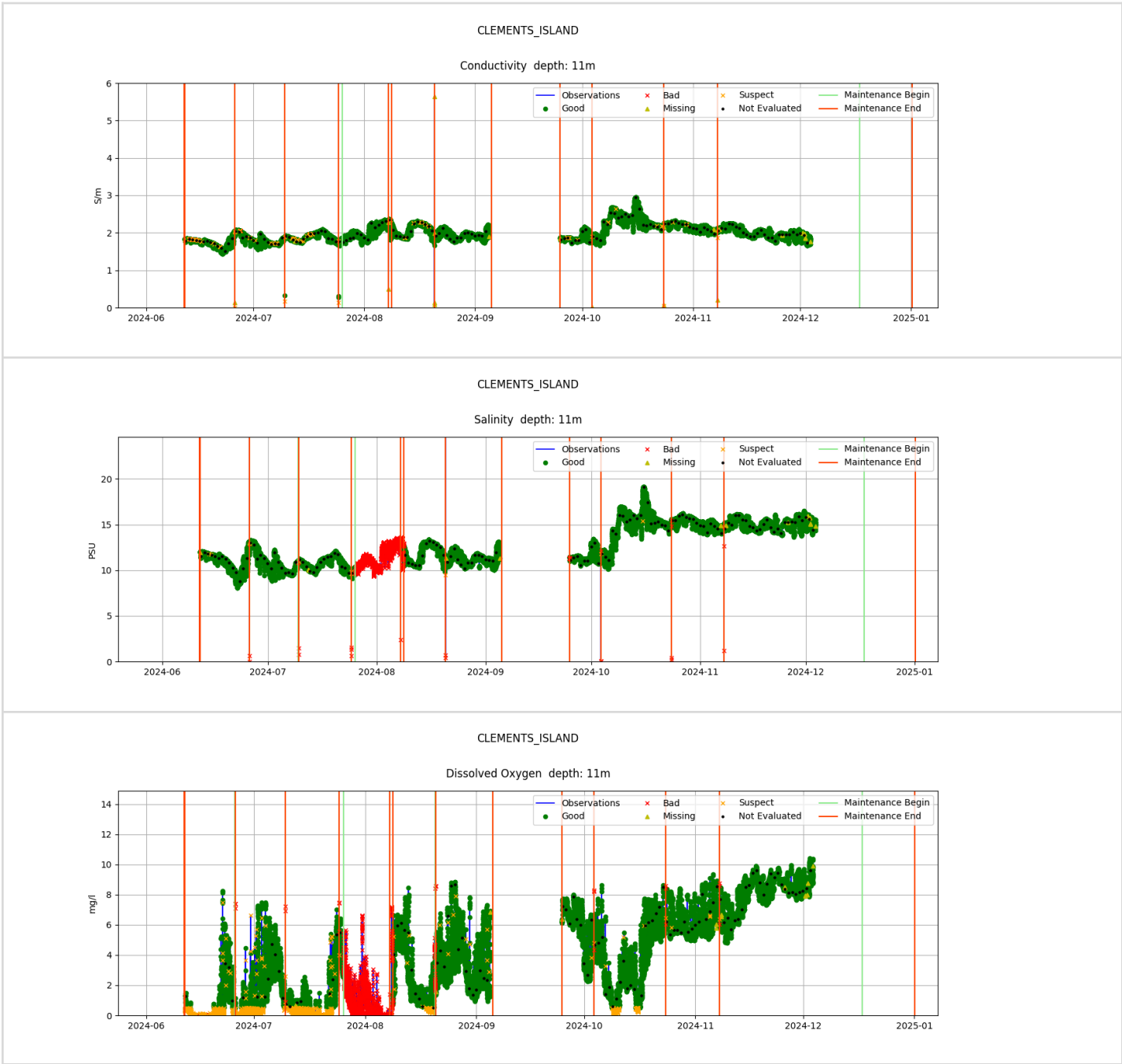


Clements Island 8m



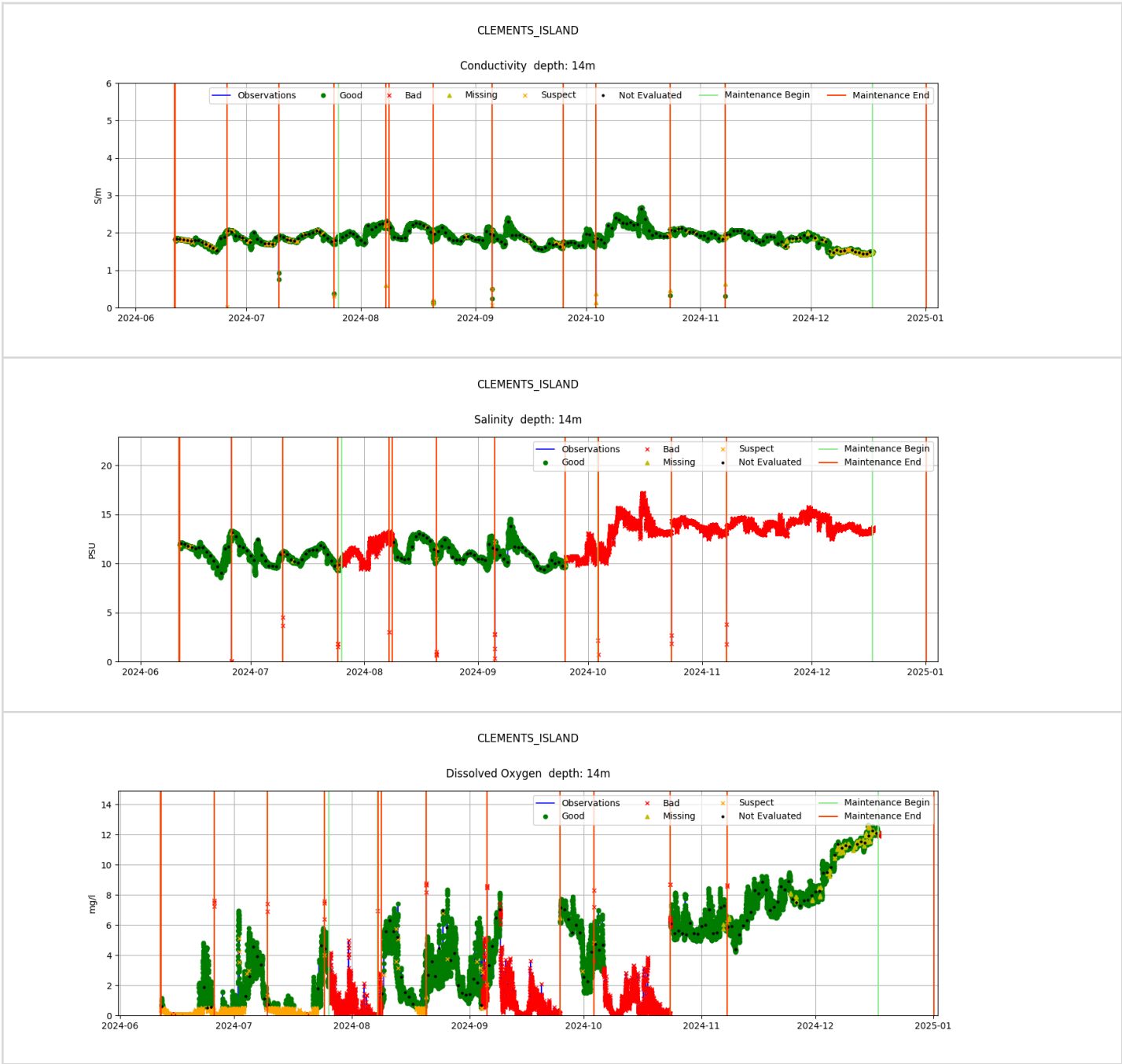


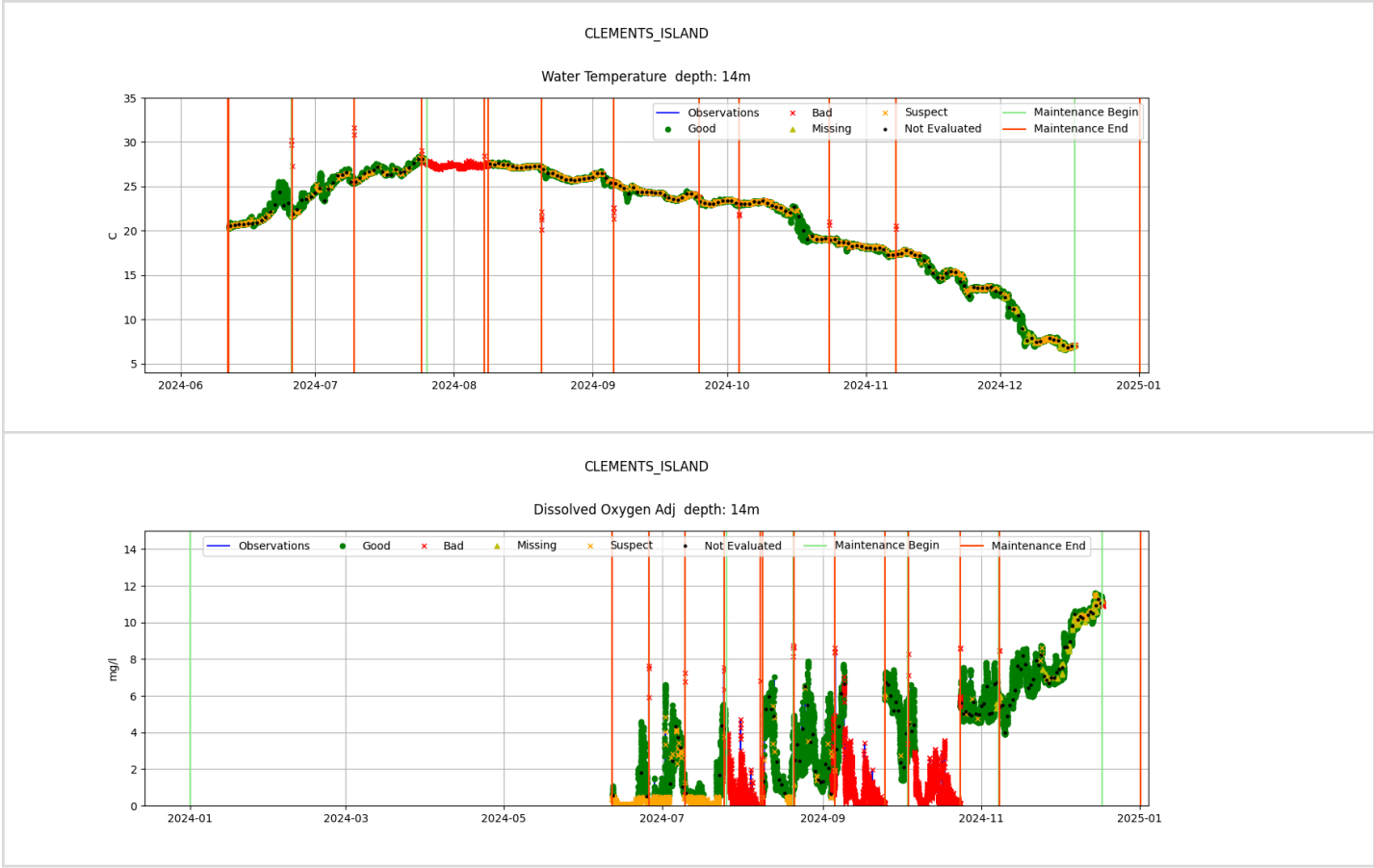
Clements Island 11m





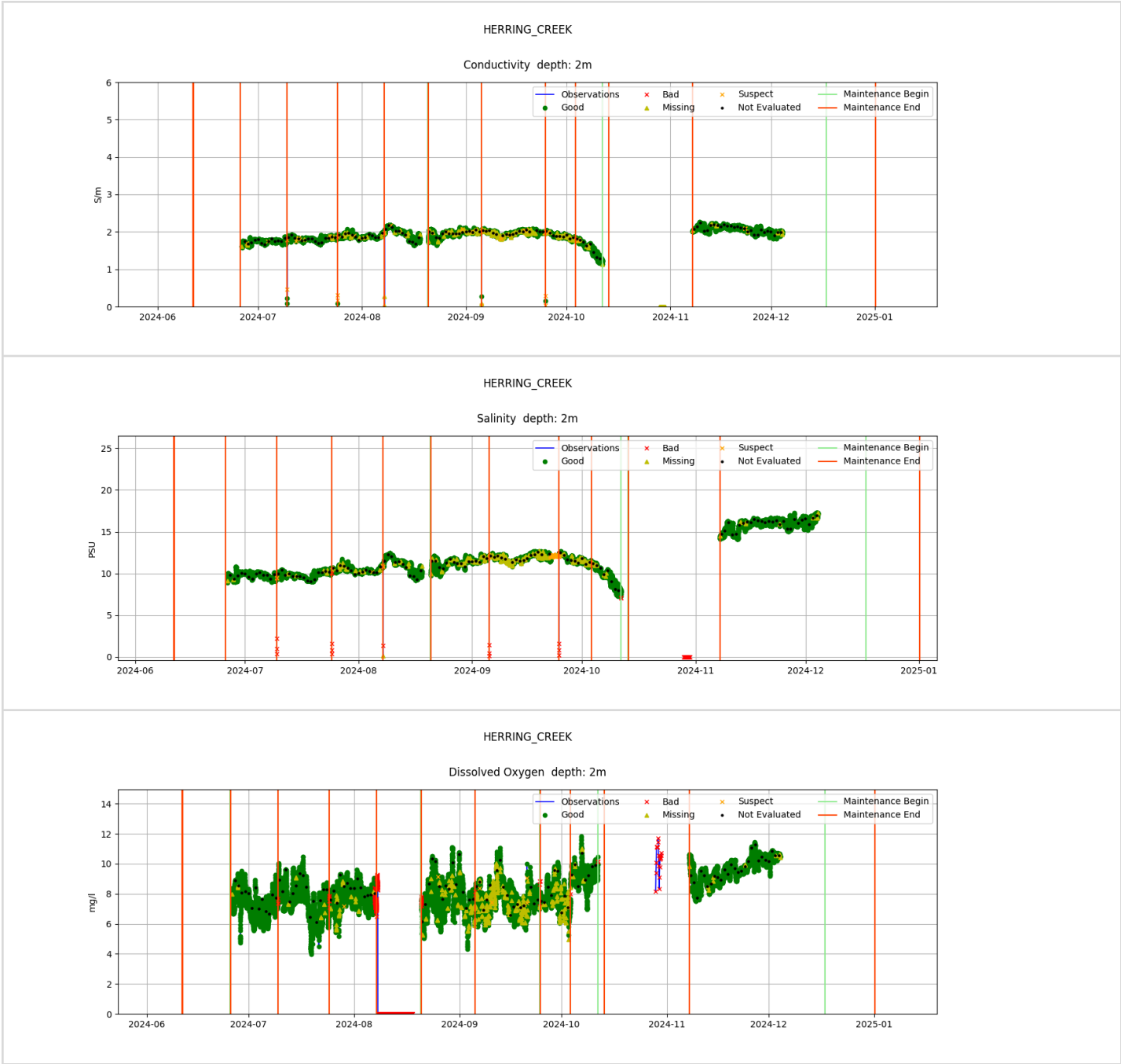
Clements Island 14m

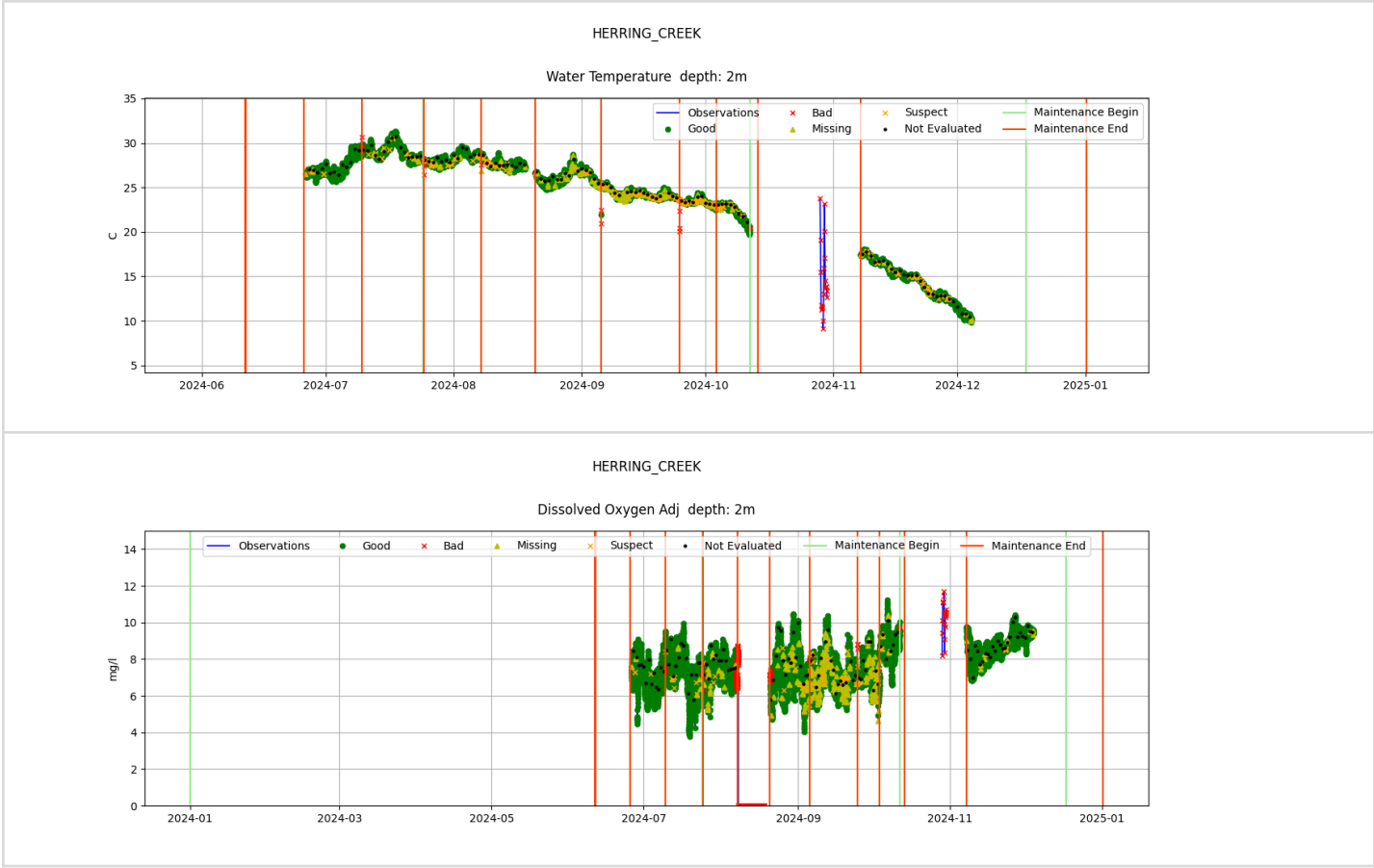




## 7.5 Herring Creek

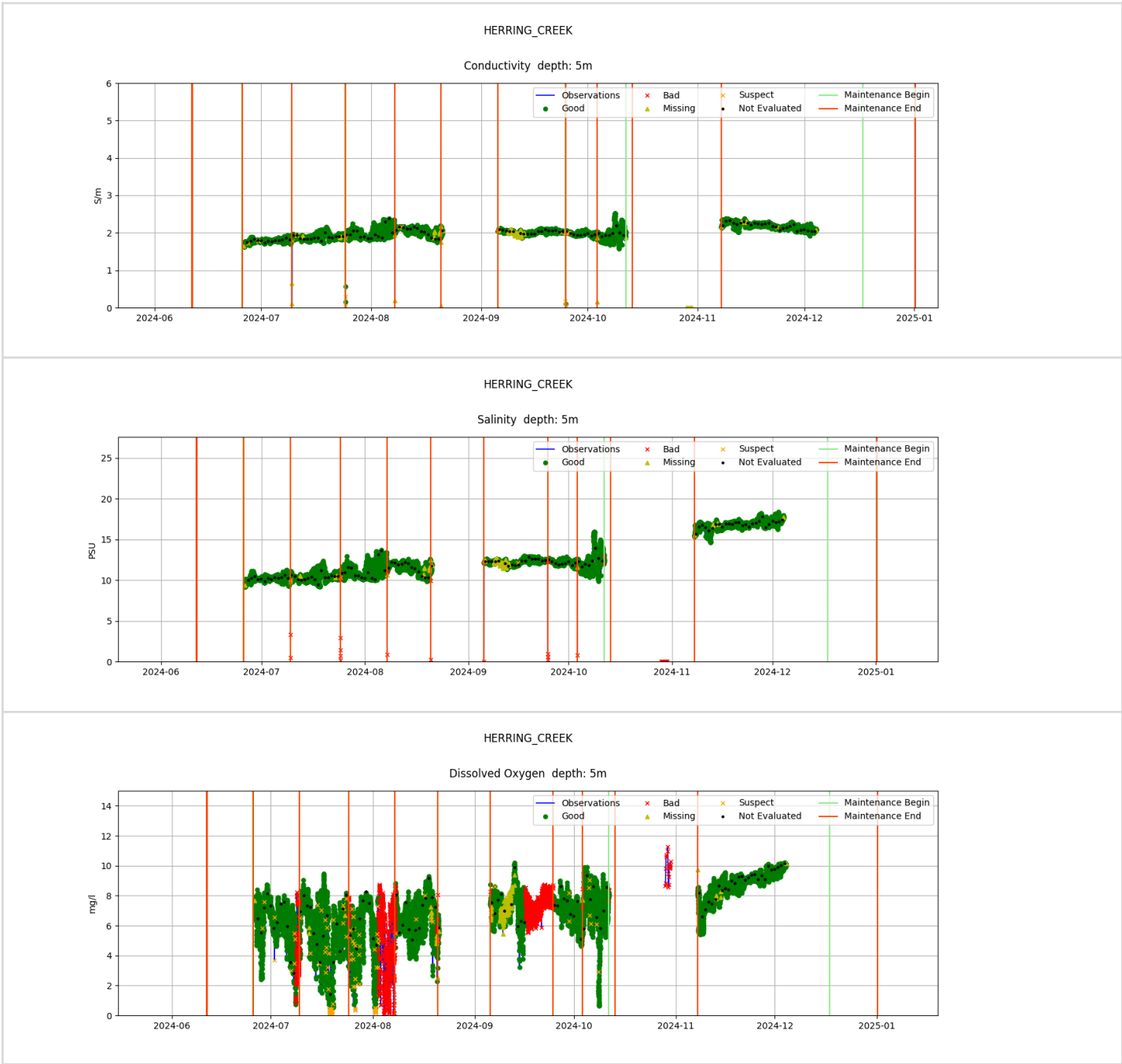
### Herring Creek 2m

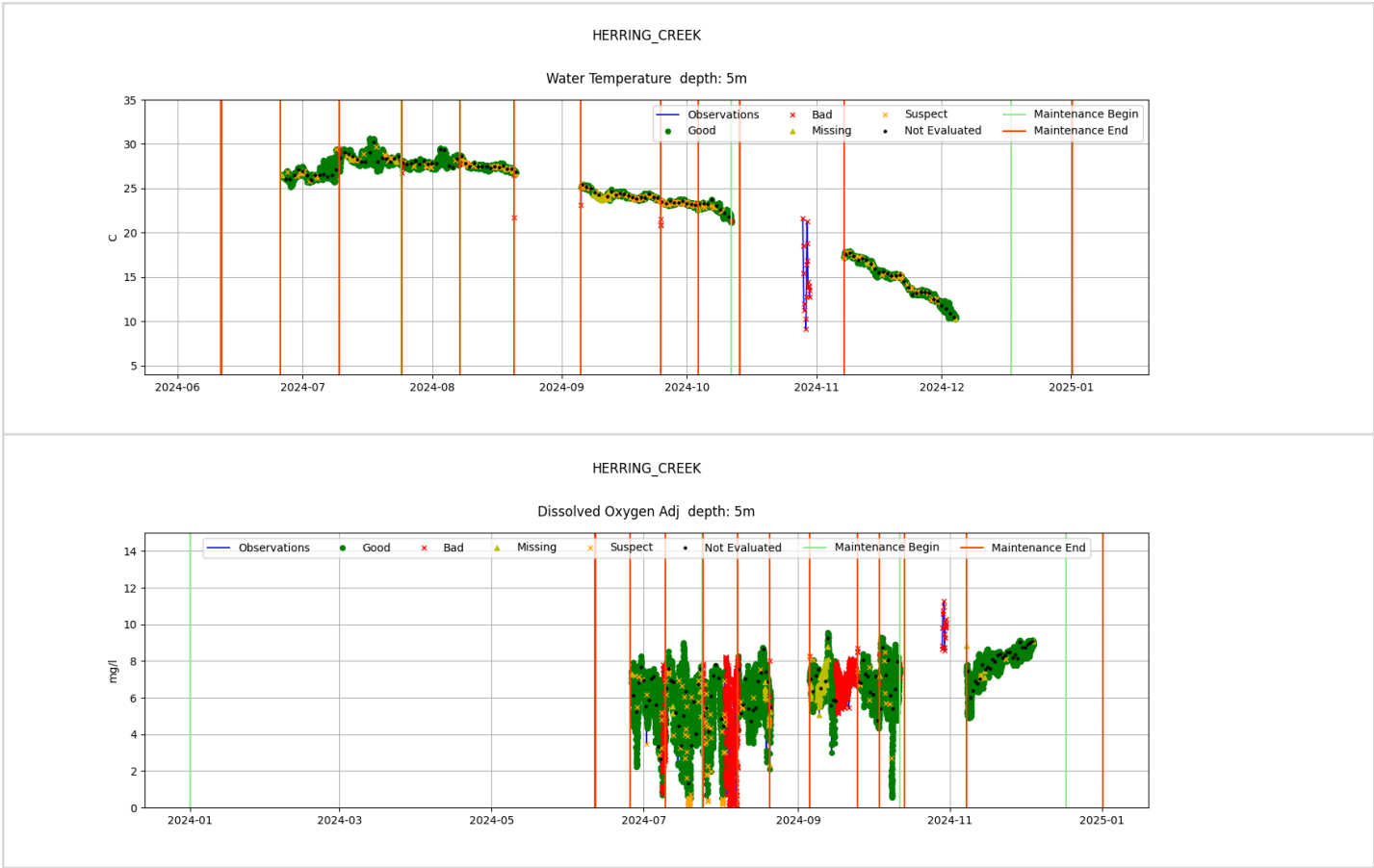




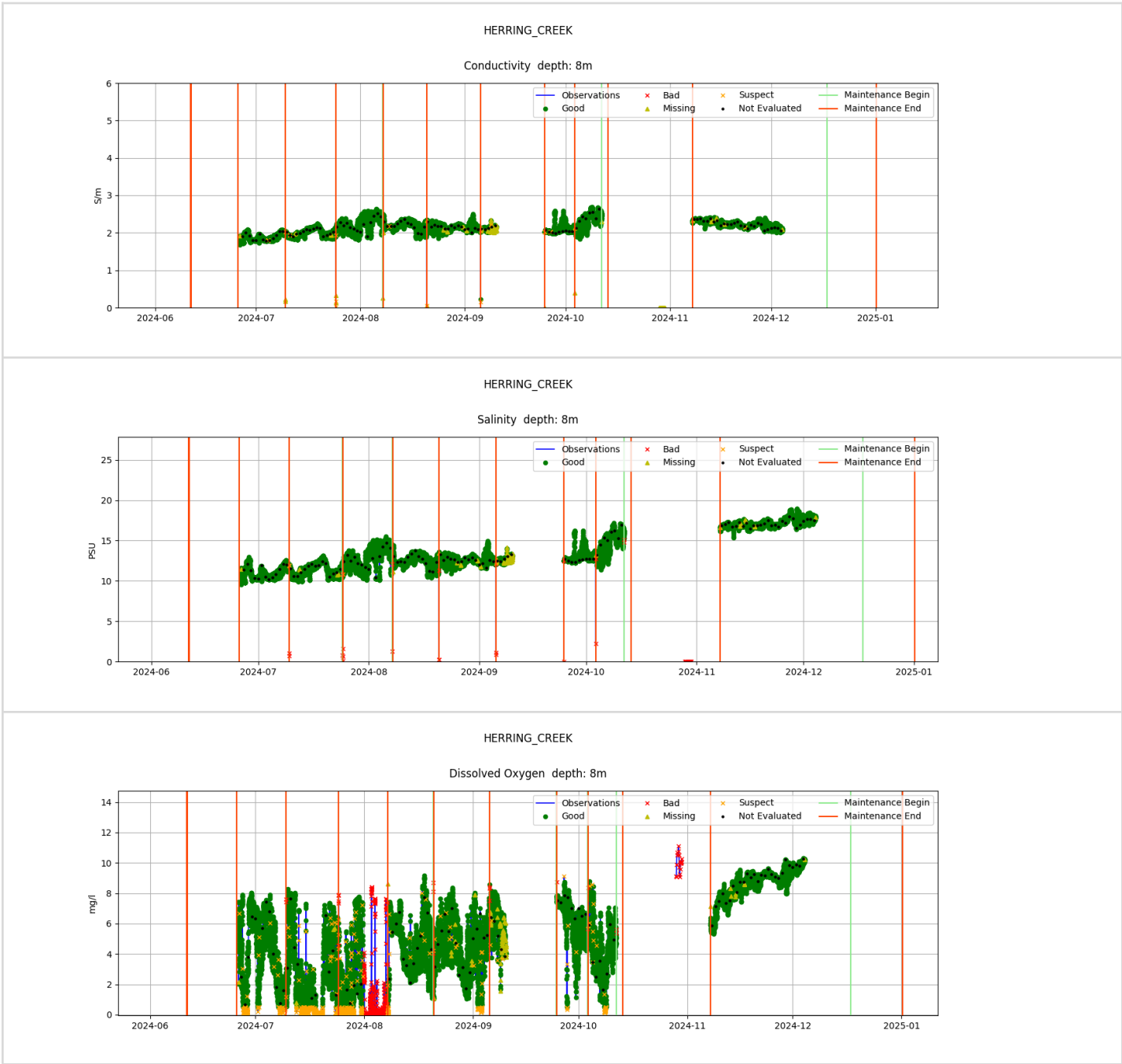


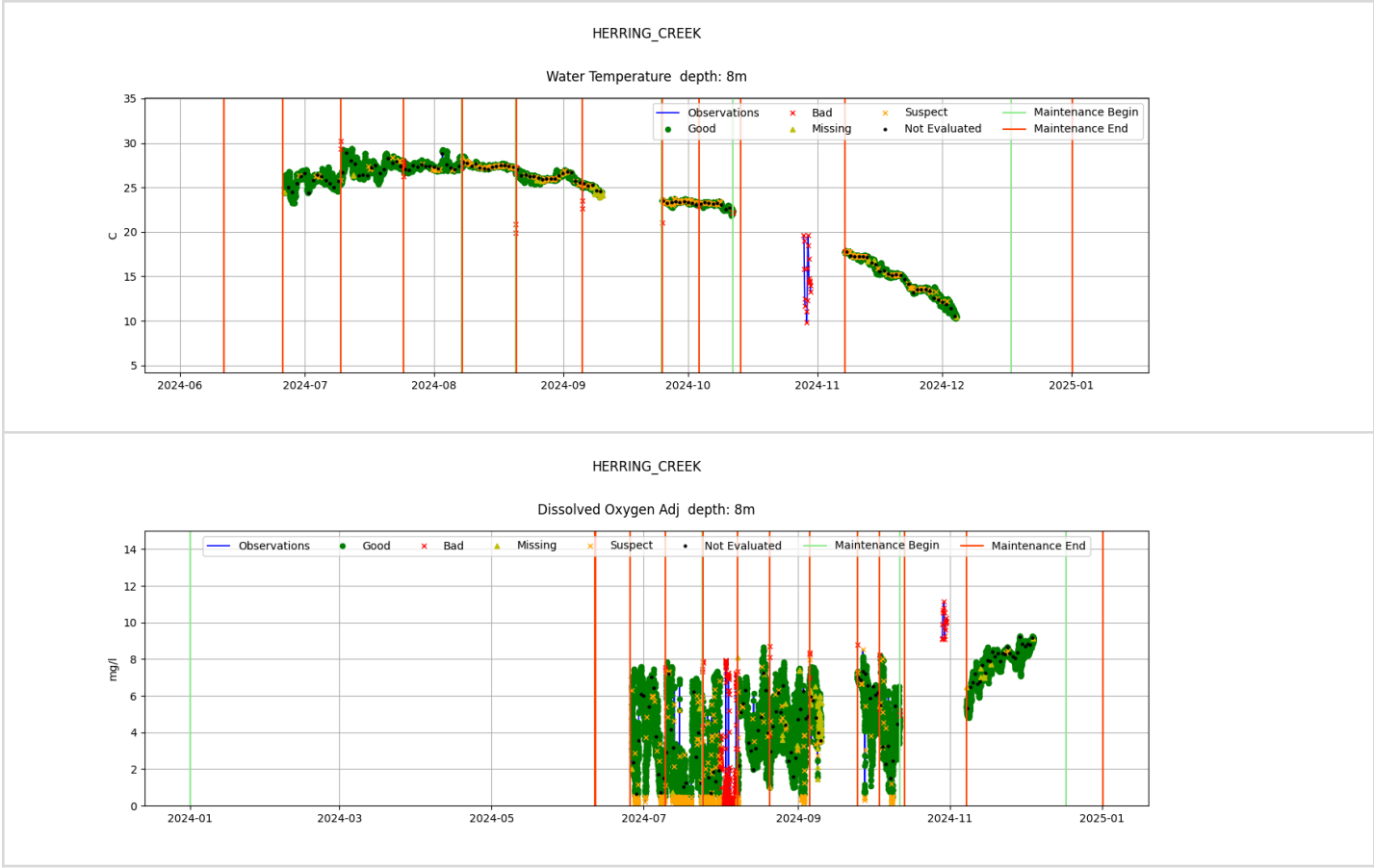
Herring Creek 5m



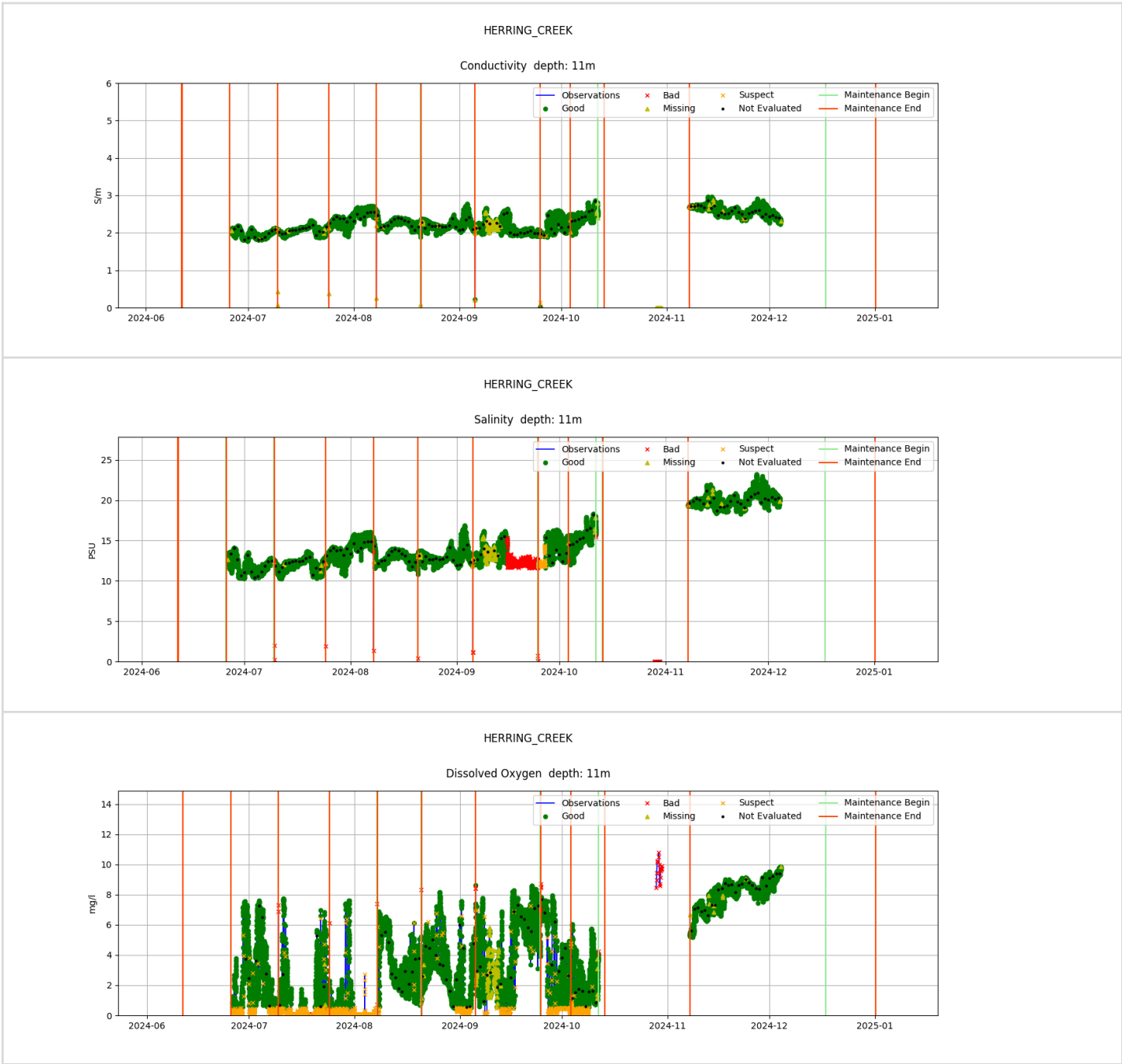


Herring Creek 8m



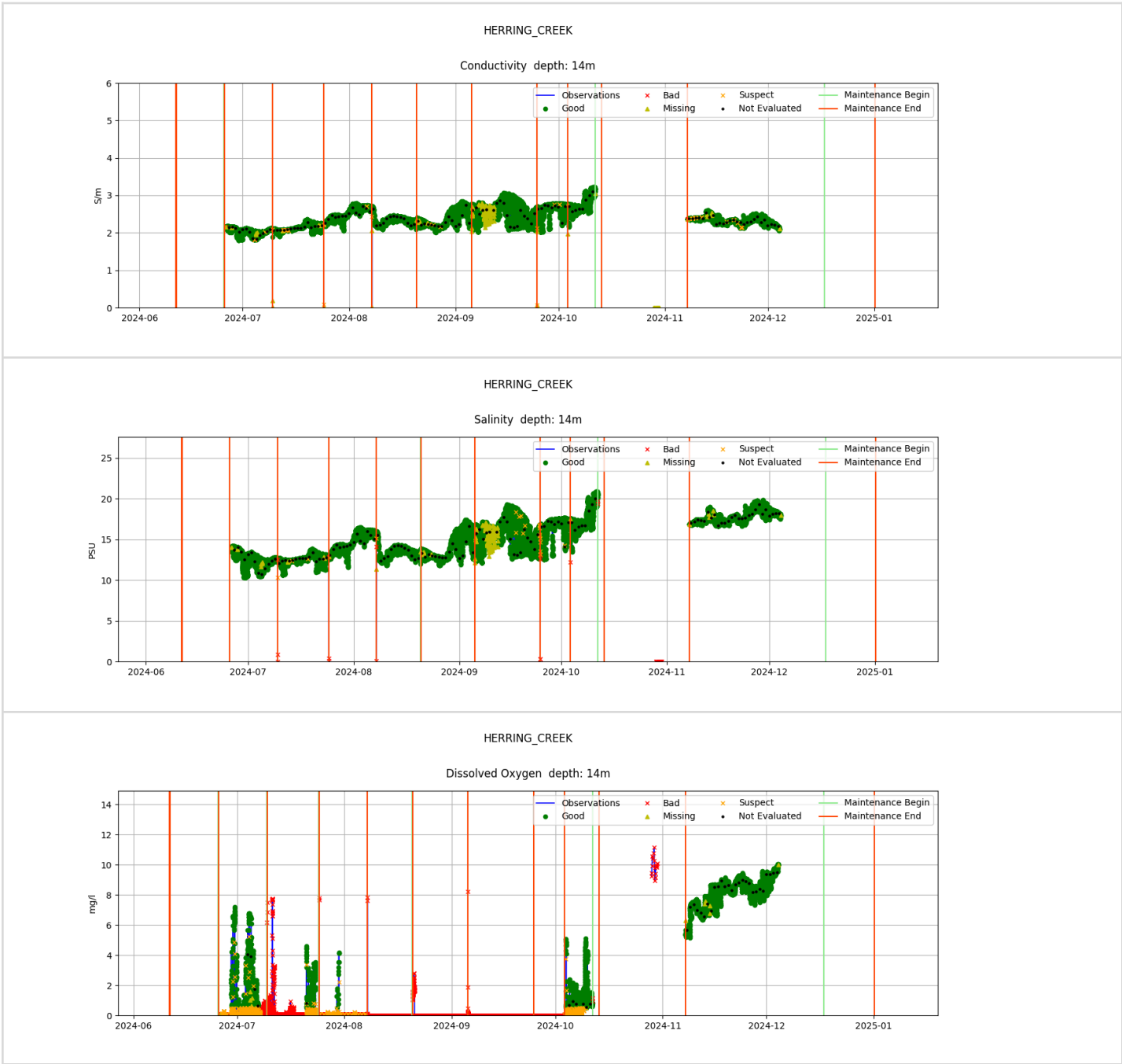


Herring Creek 11m





Herring Creek 14m

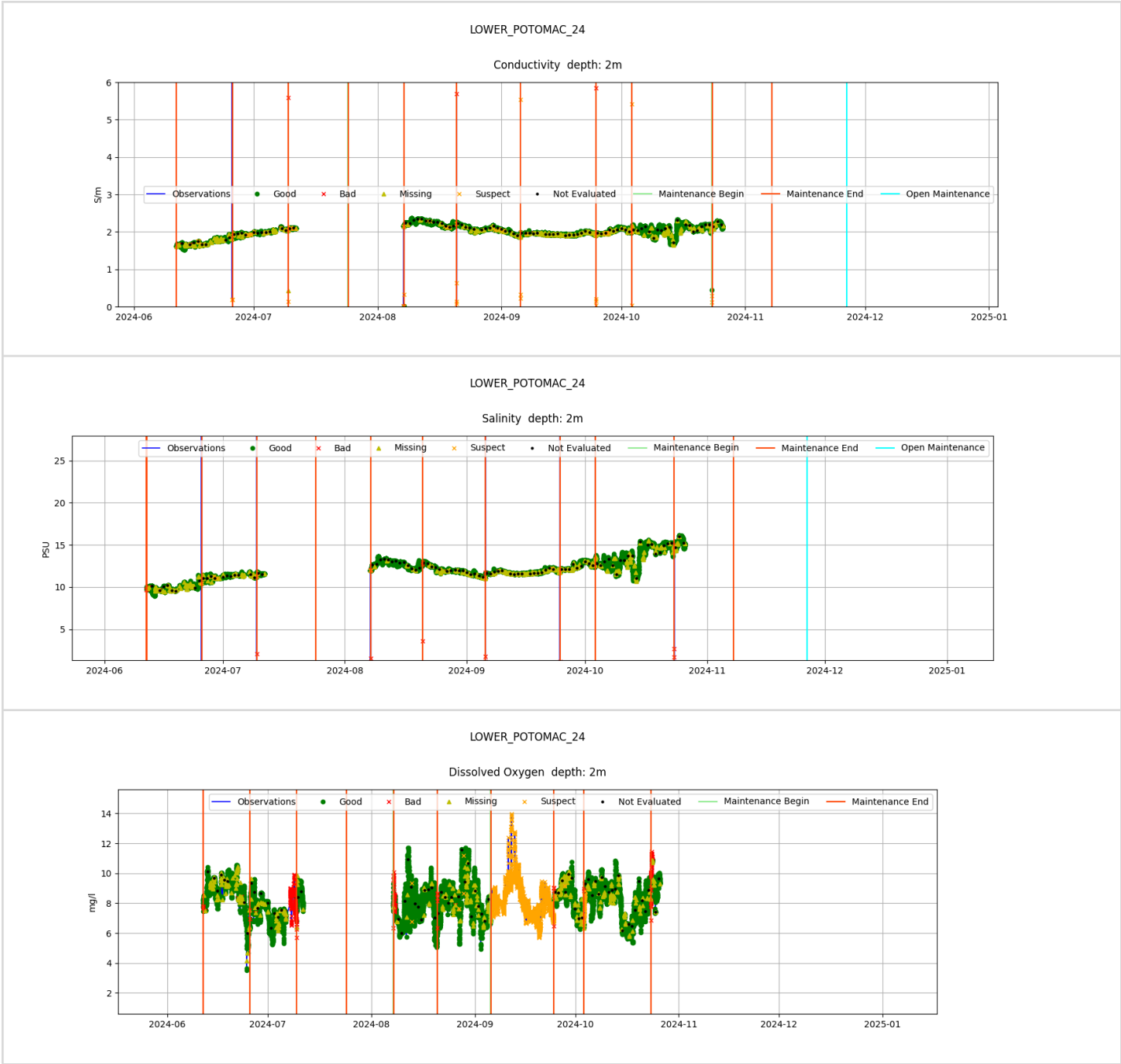


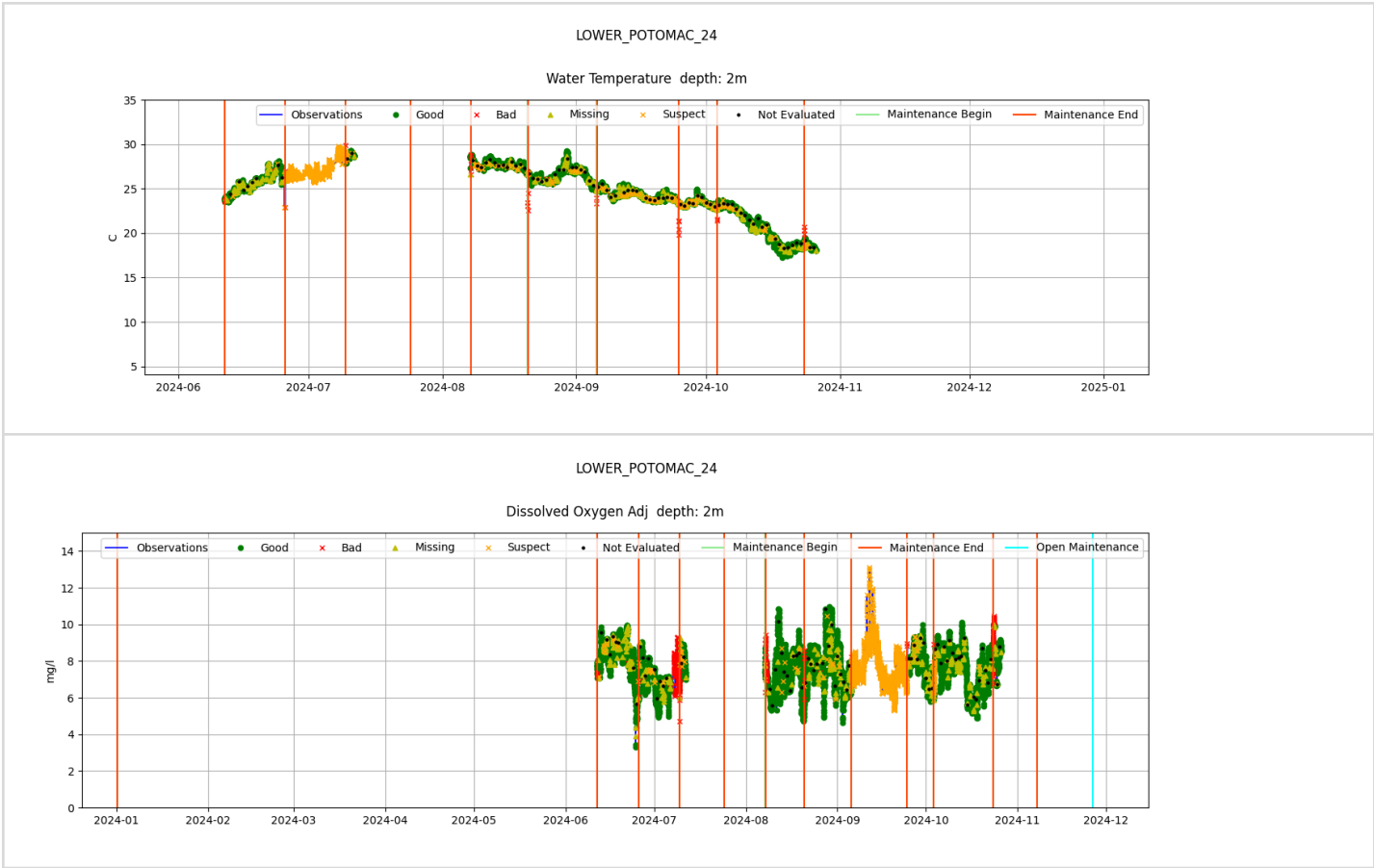




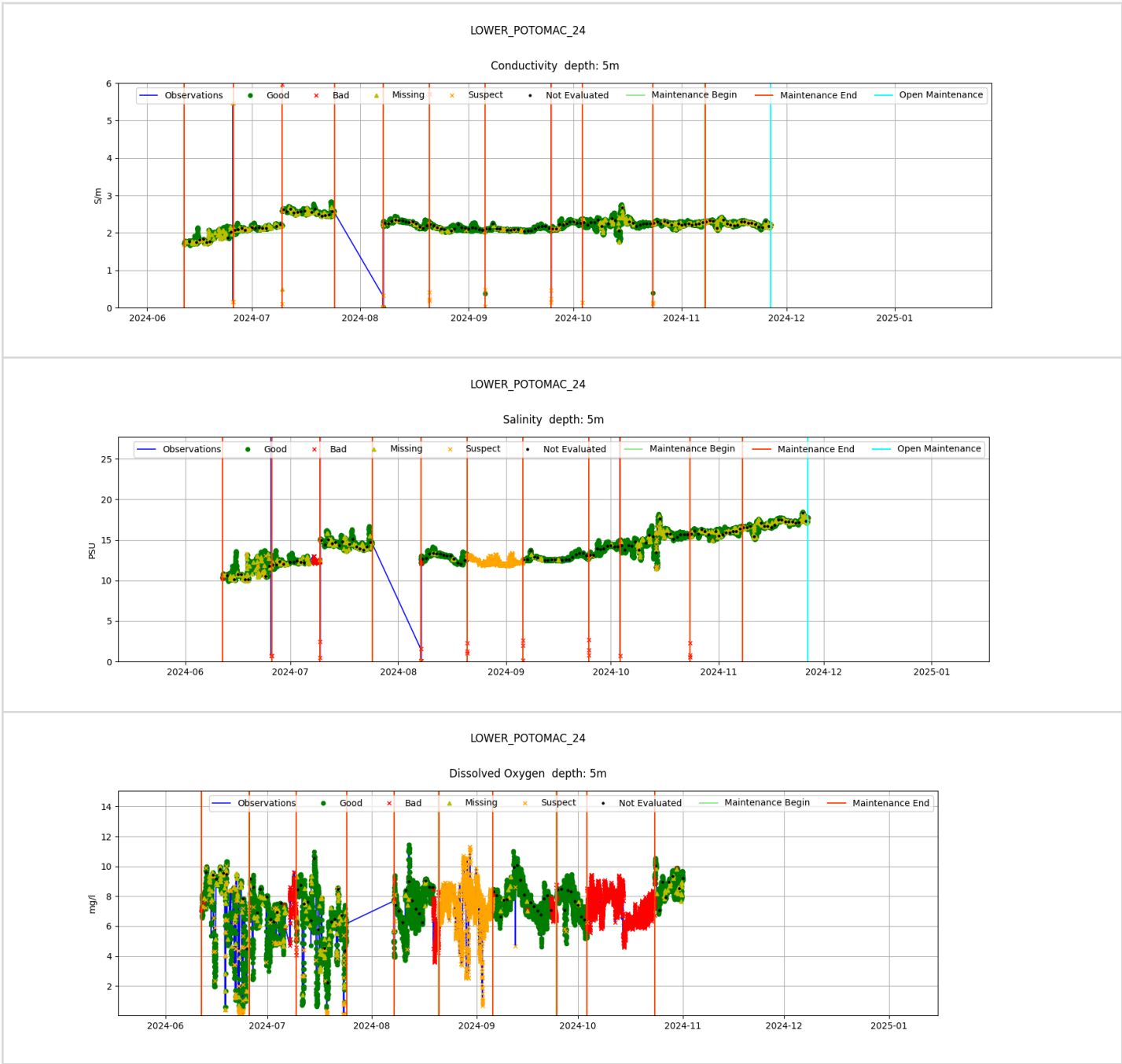
## 7.6 Lower Potomac

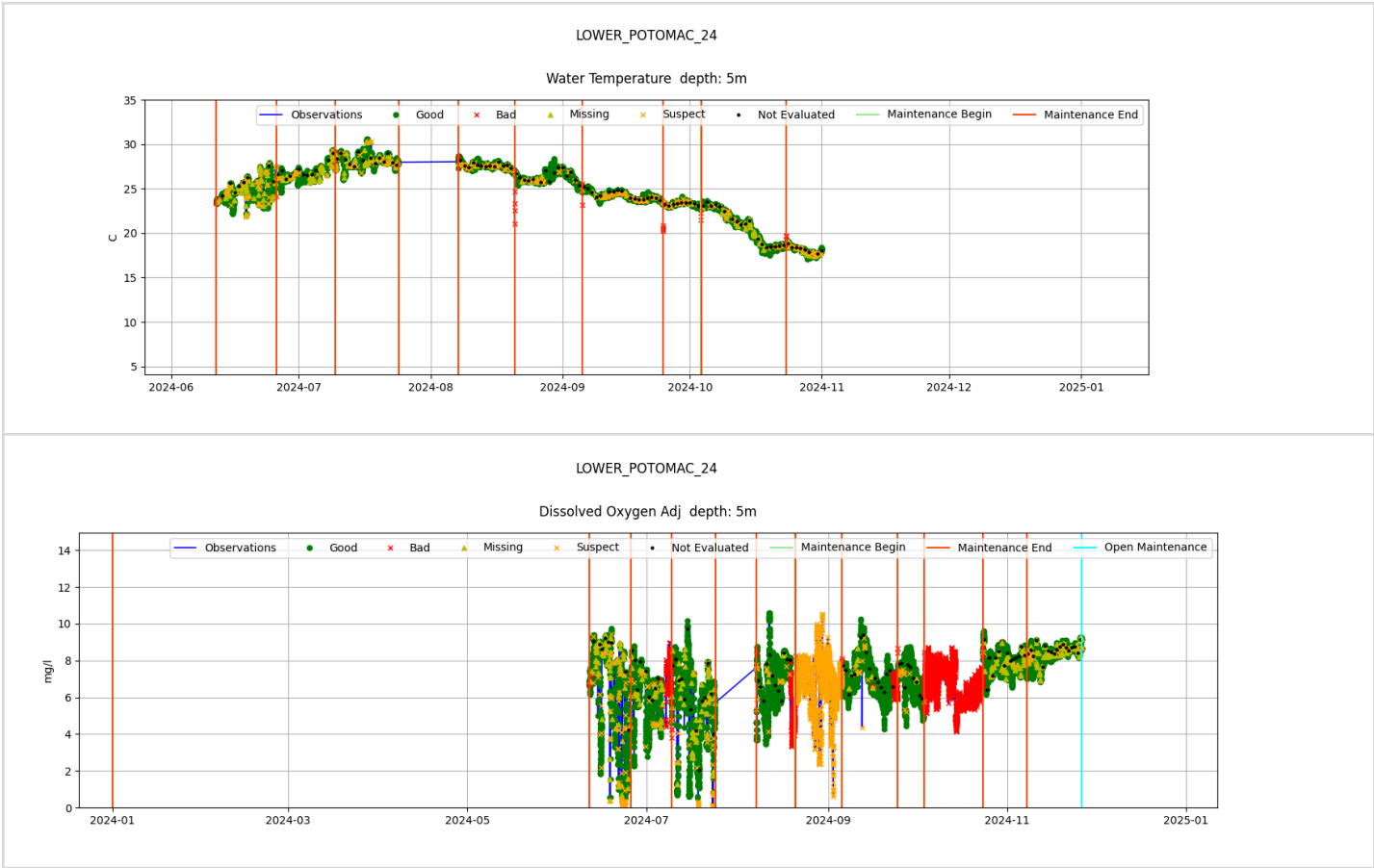
### Lower Potomac 2m



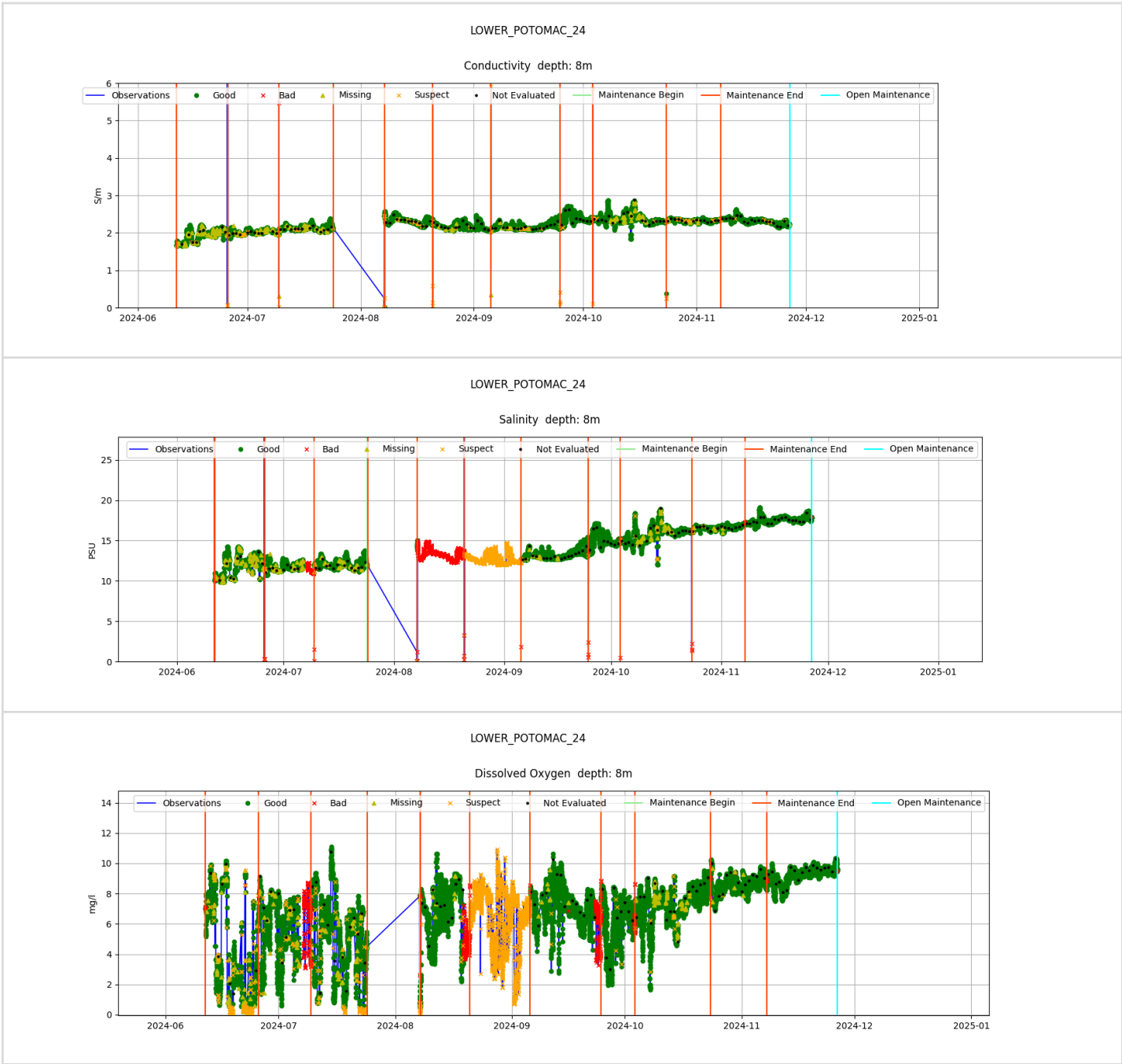


Lower Potomac 5m



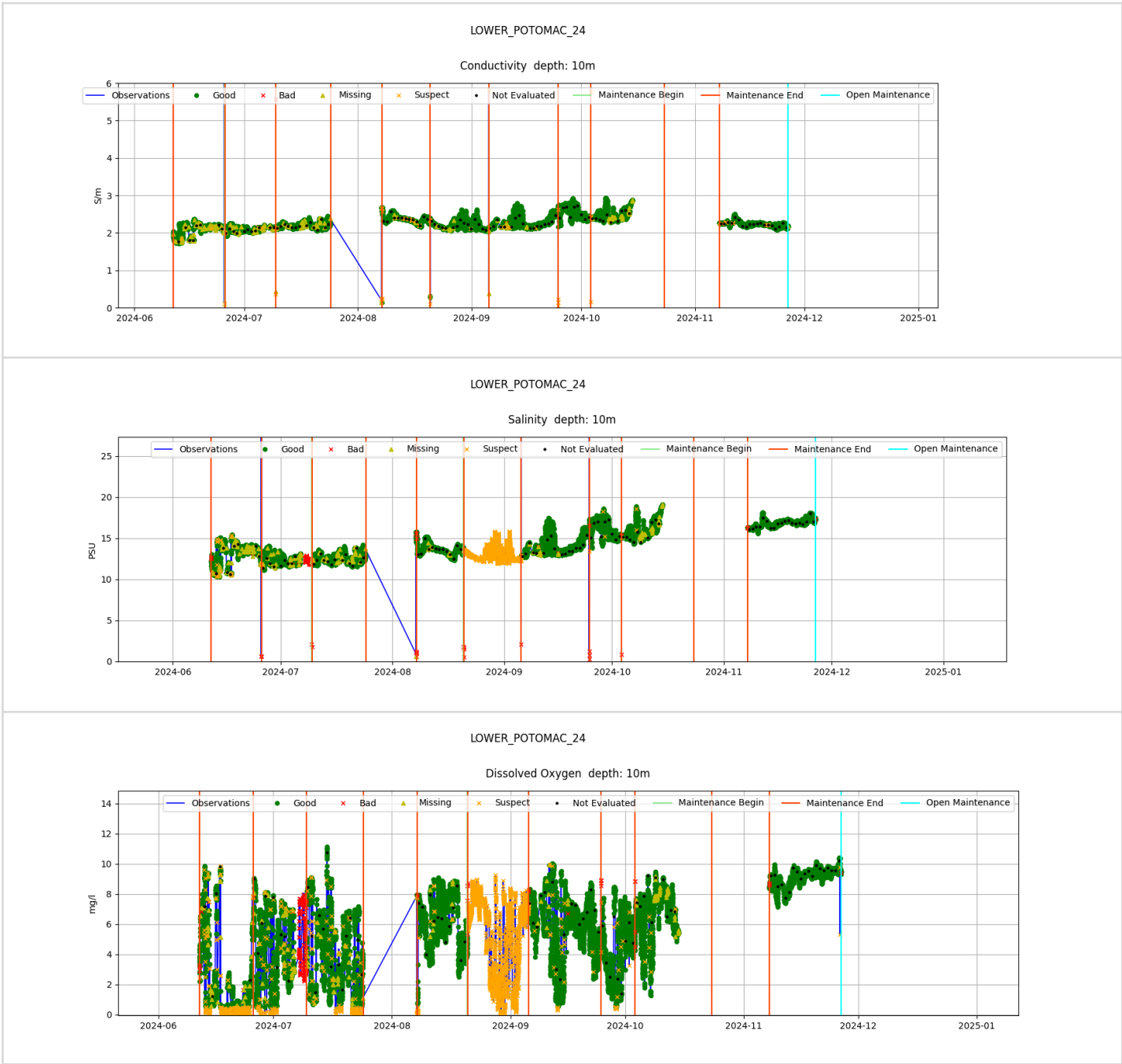


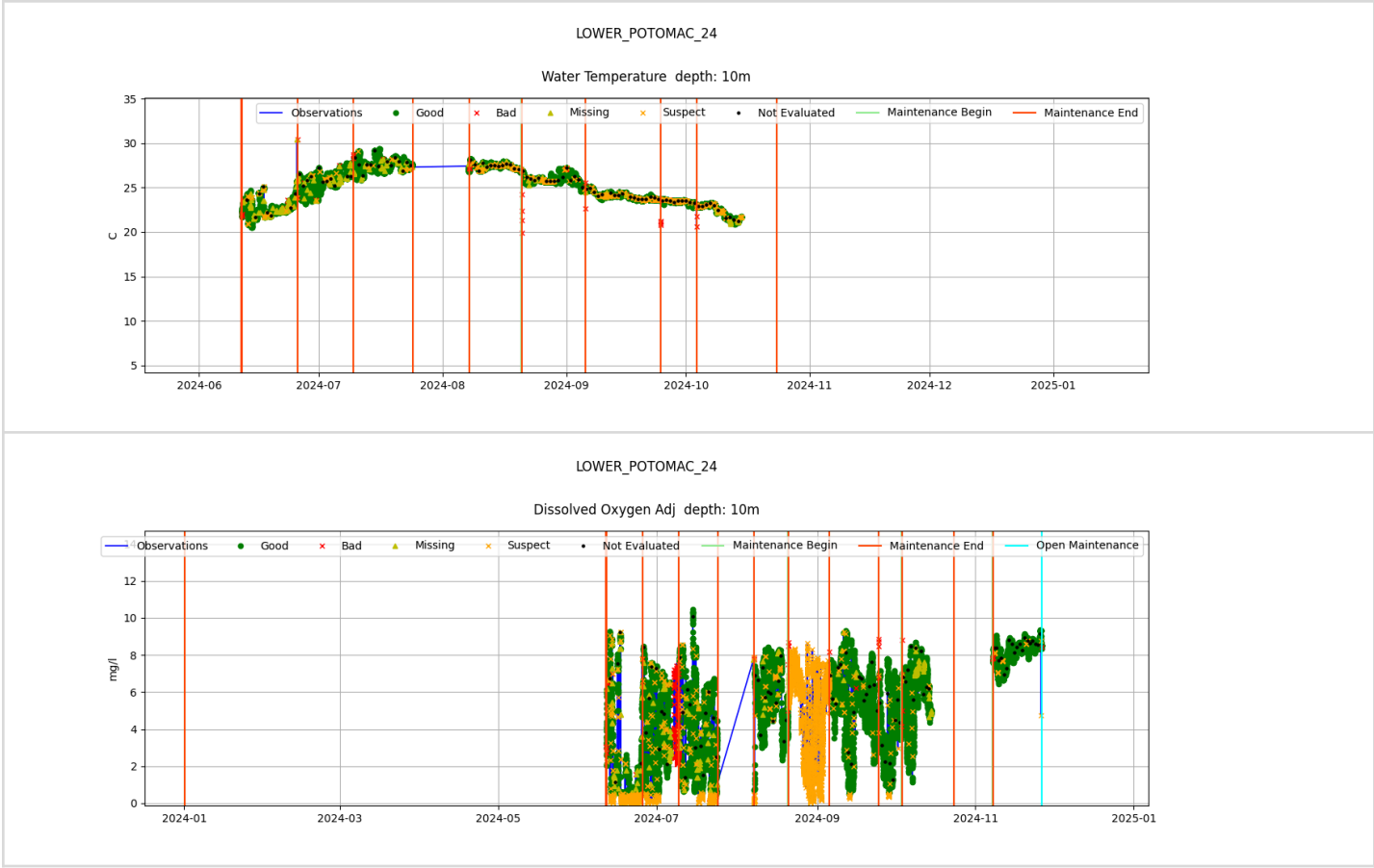
Lower Potomac 8m





Lower Potomac 10m



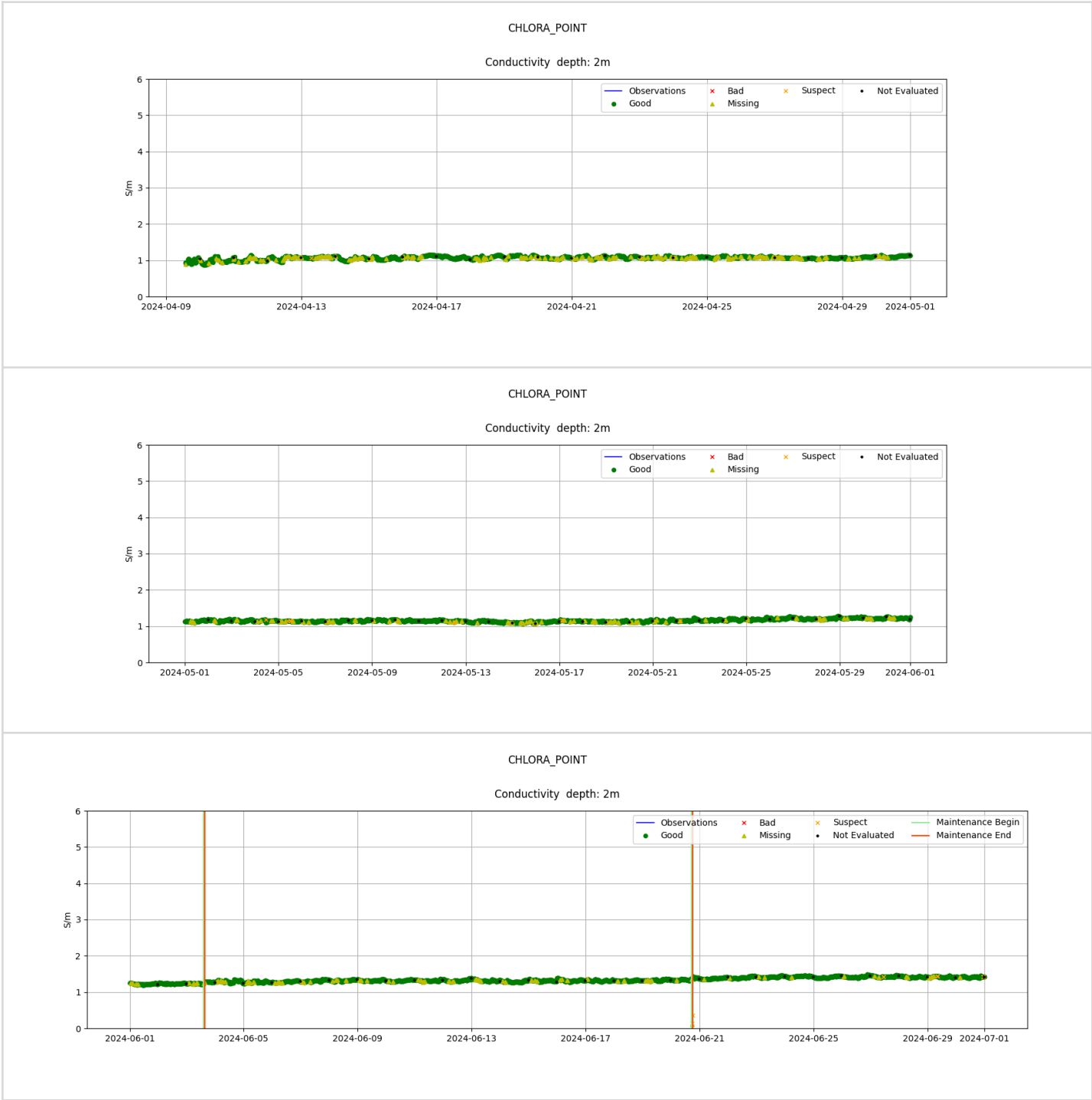


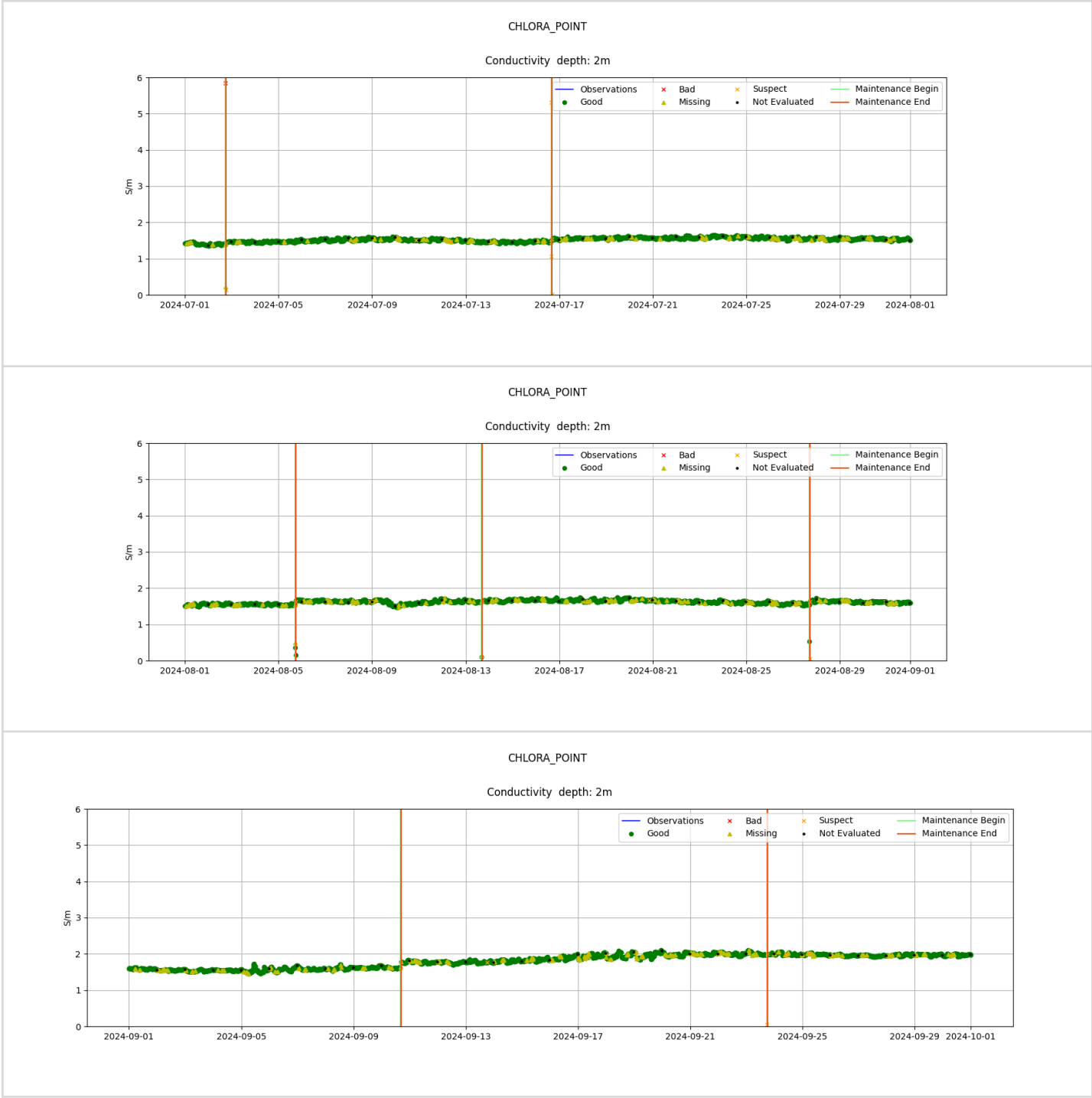


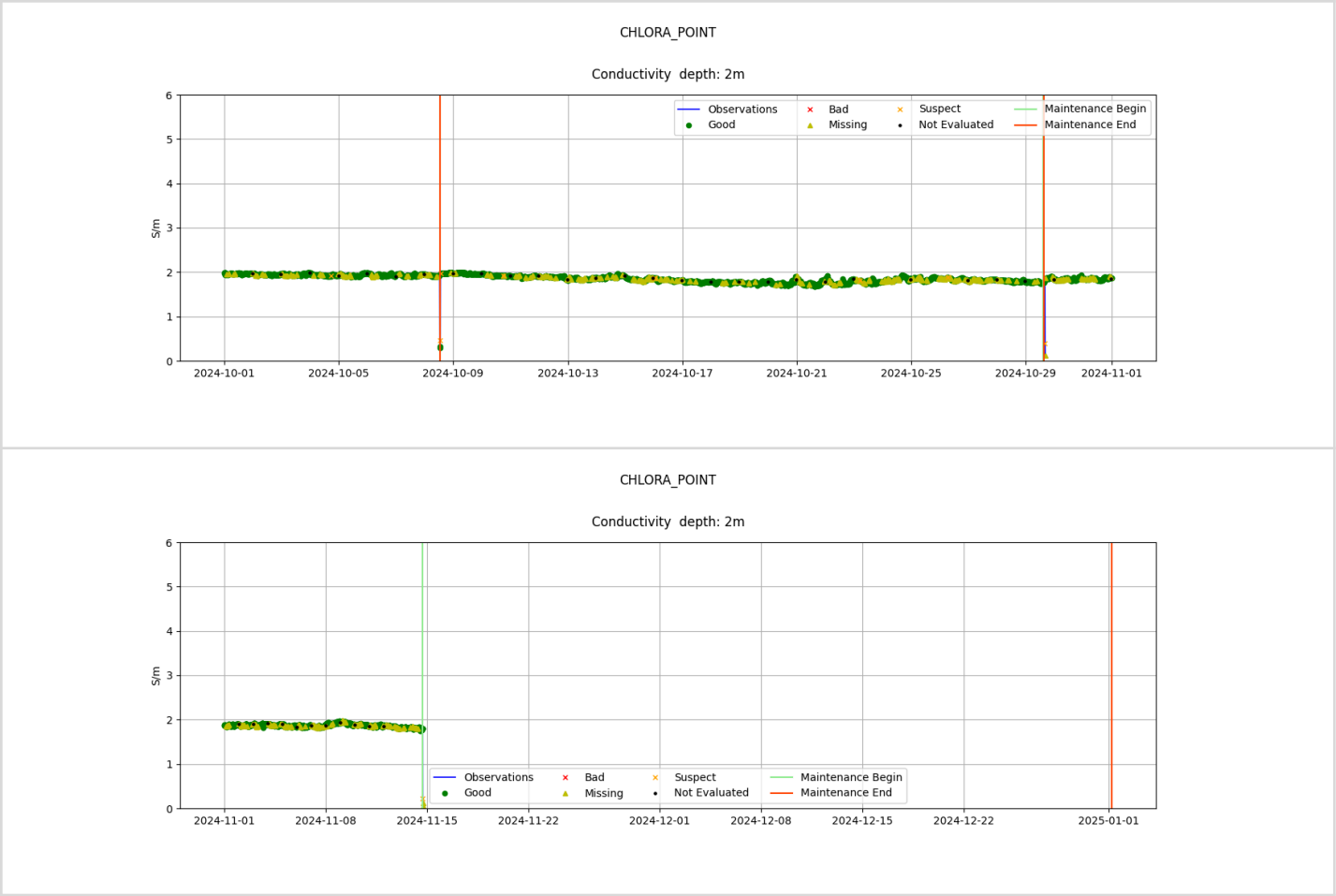
# 8. Monthly Plots

## 8.1 Chlora Point

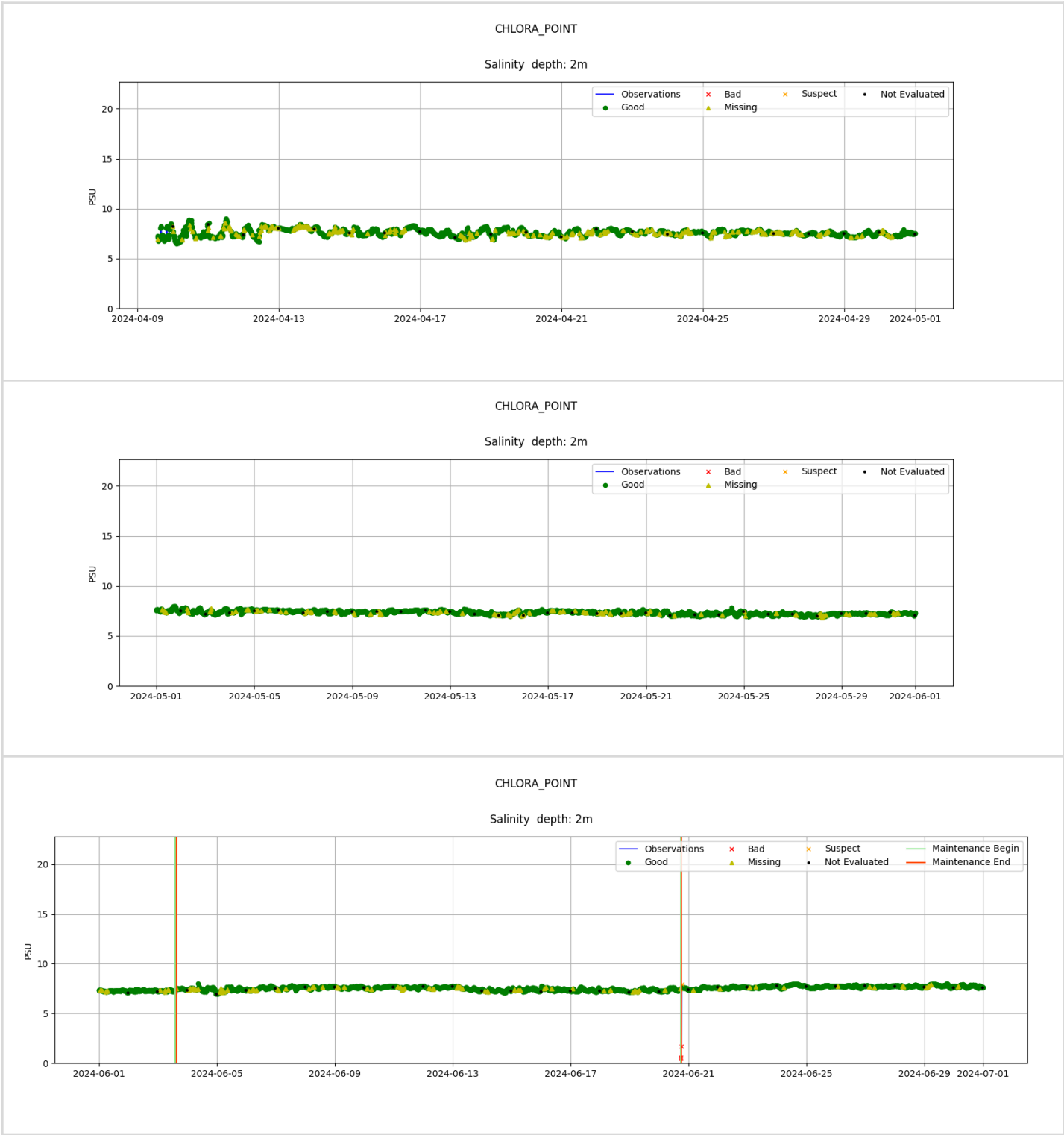
### Chlora Point 2m Conductivity

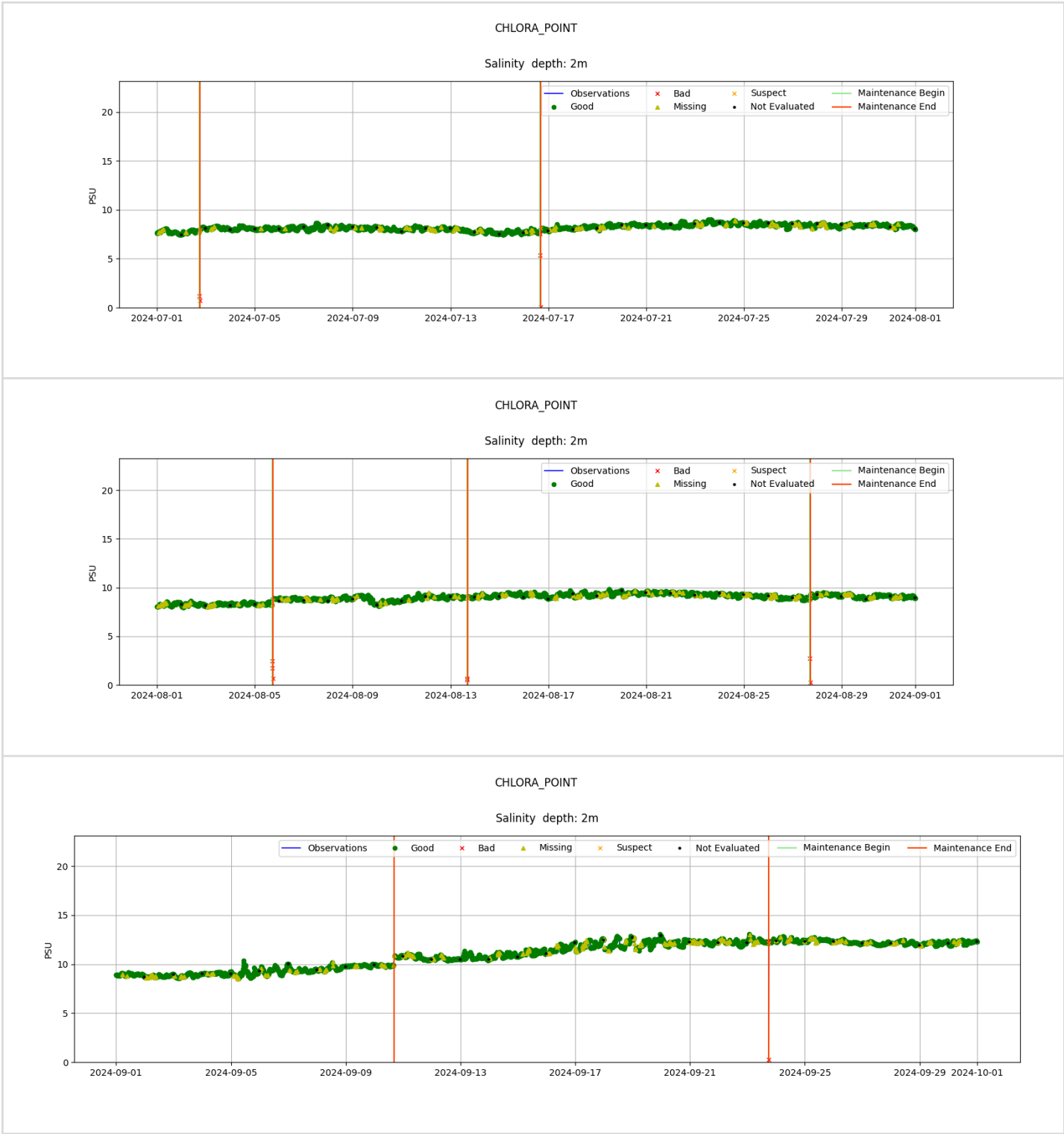






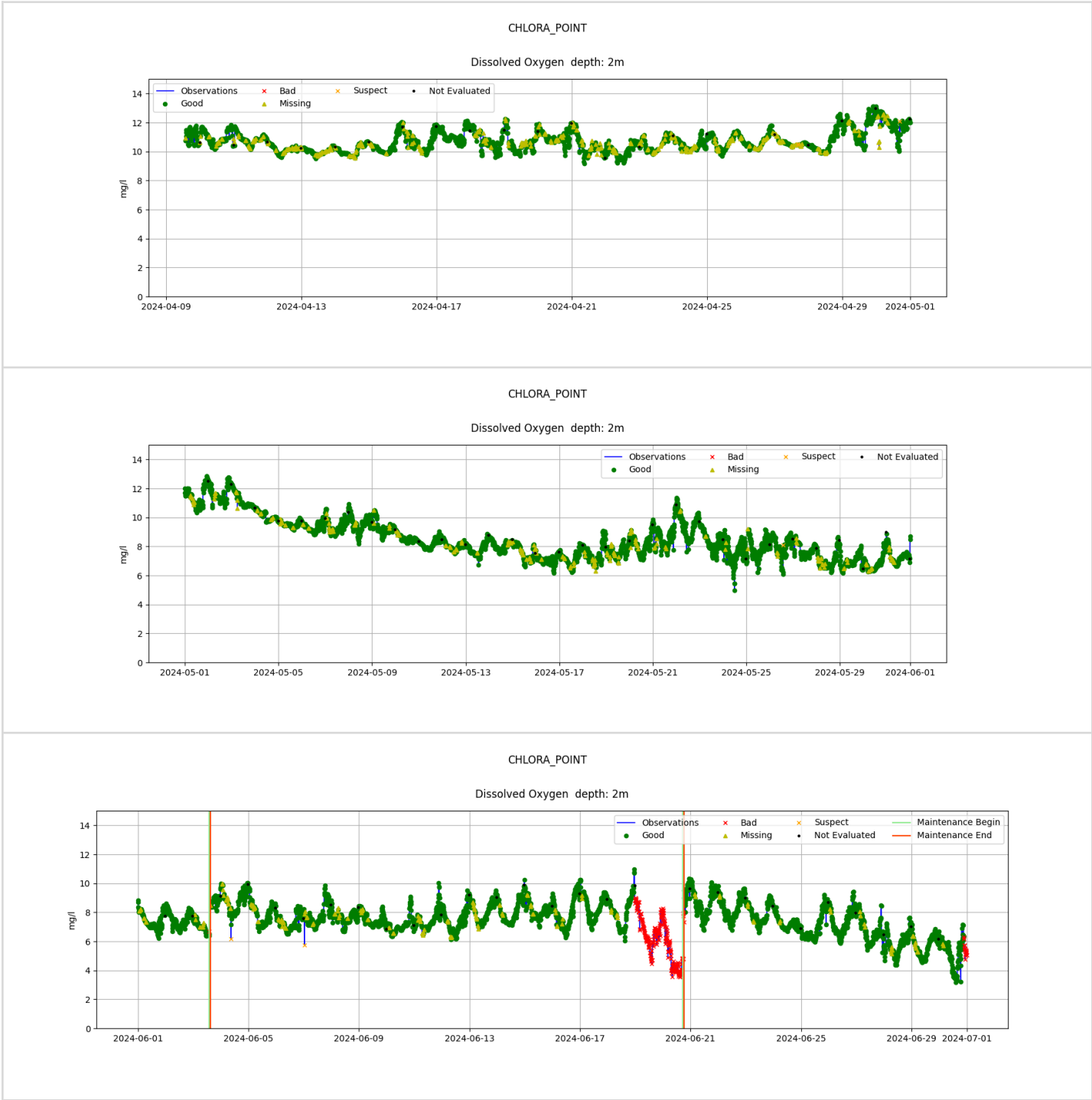
Chlora Point 2m Salinity

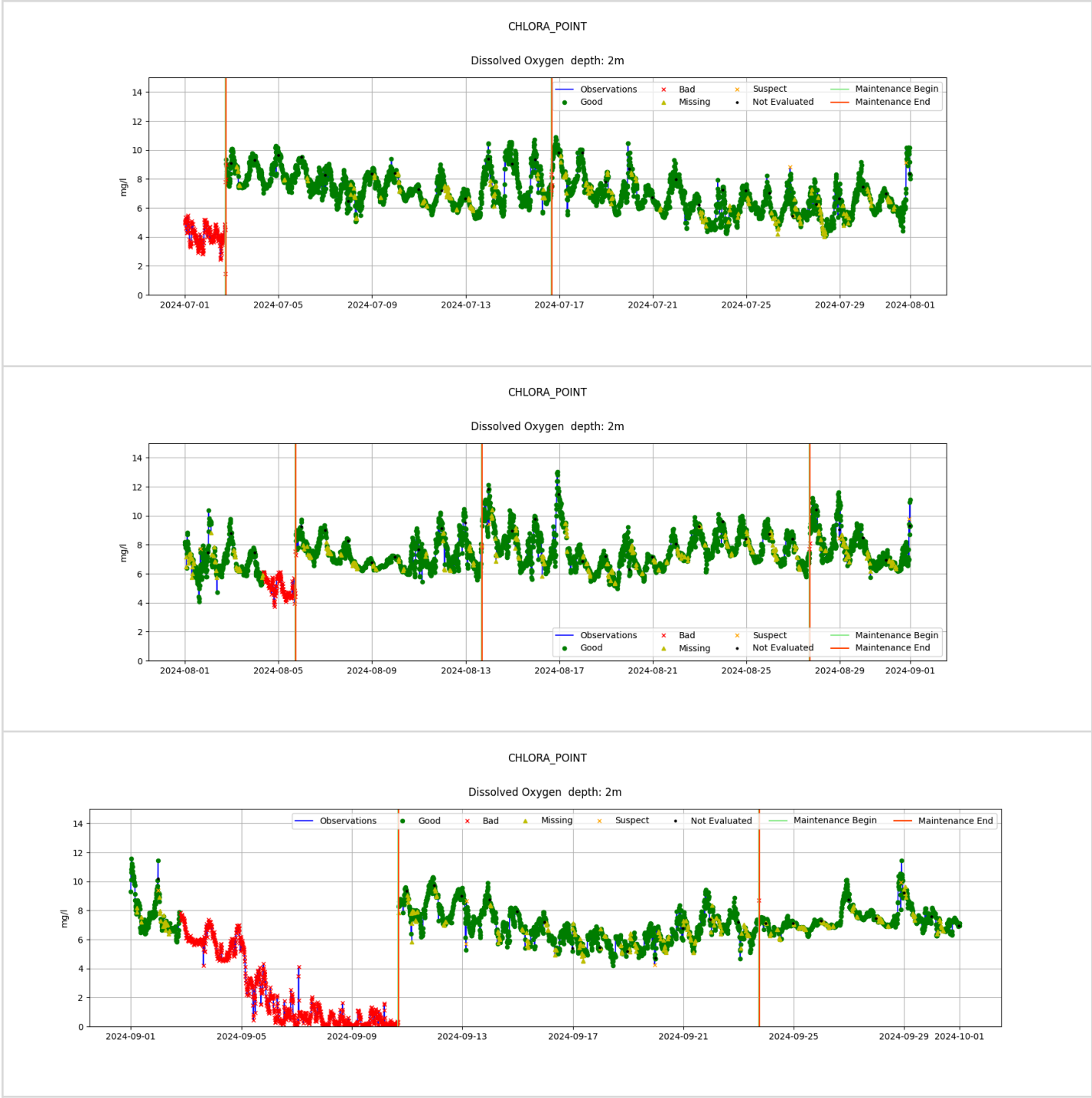






Chlora Point 2m Dissolved Oxygen

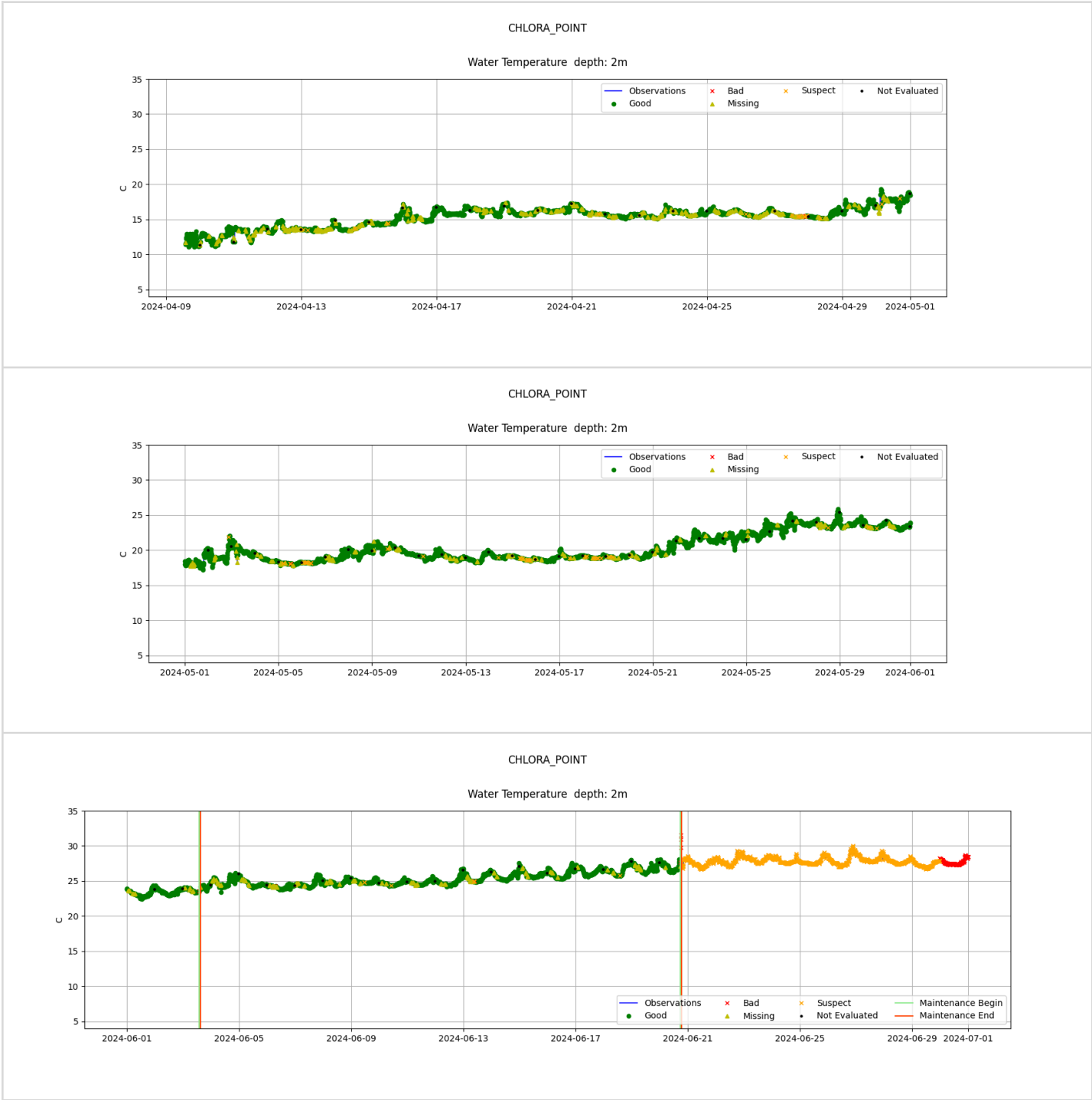


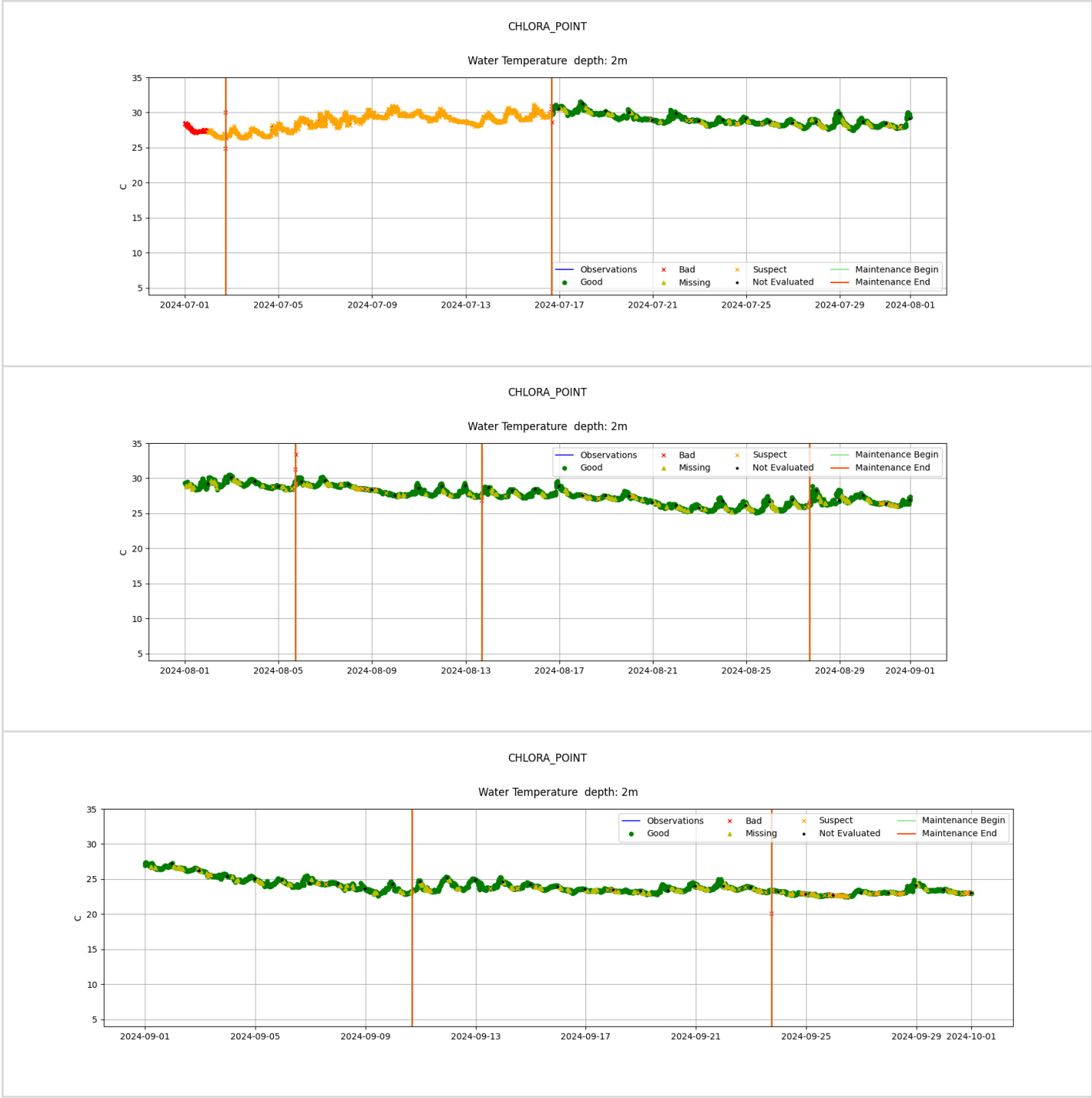






Chlora Point 2m Water Temperature



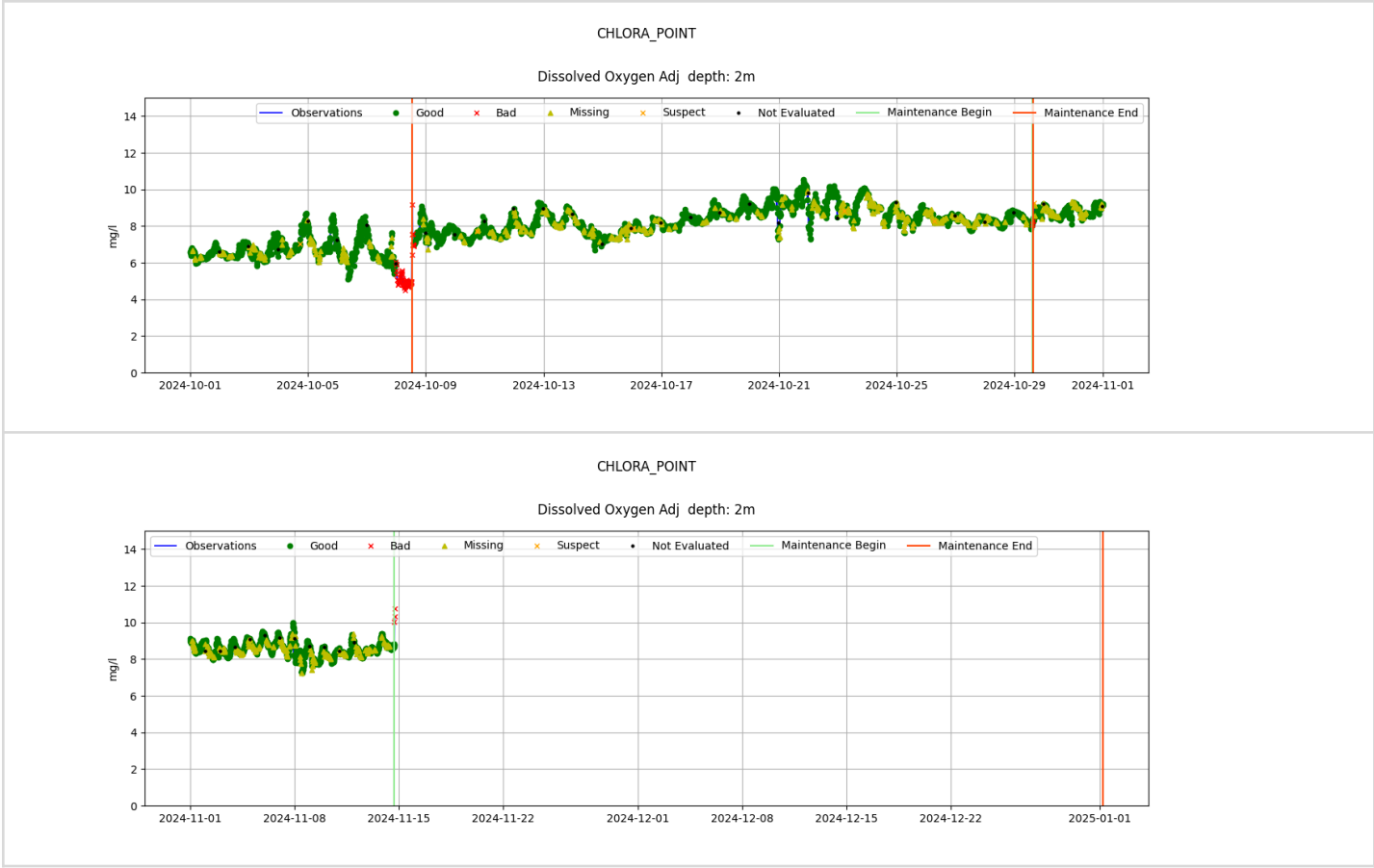




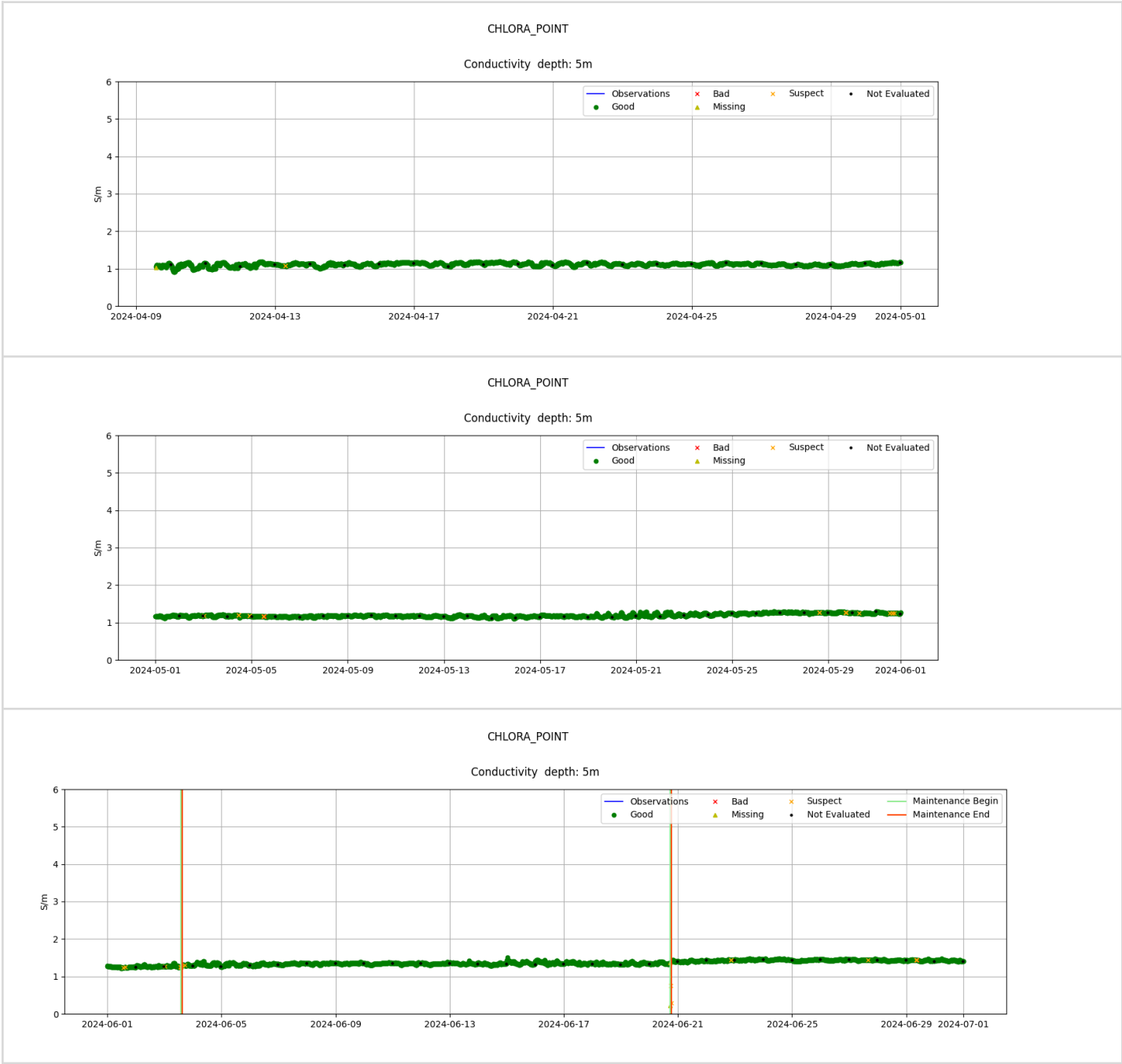
Chlora Point 2m Dissolved Oxygen Adjusted



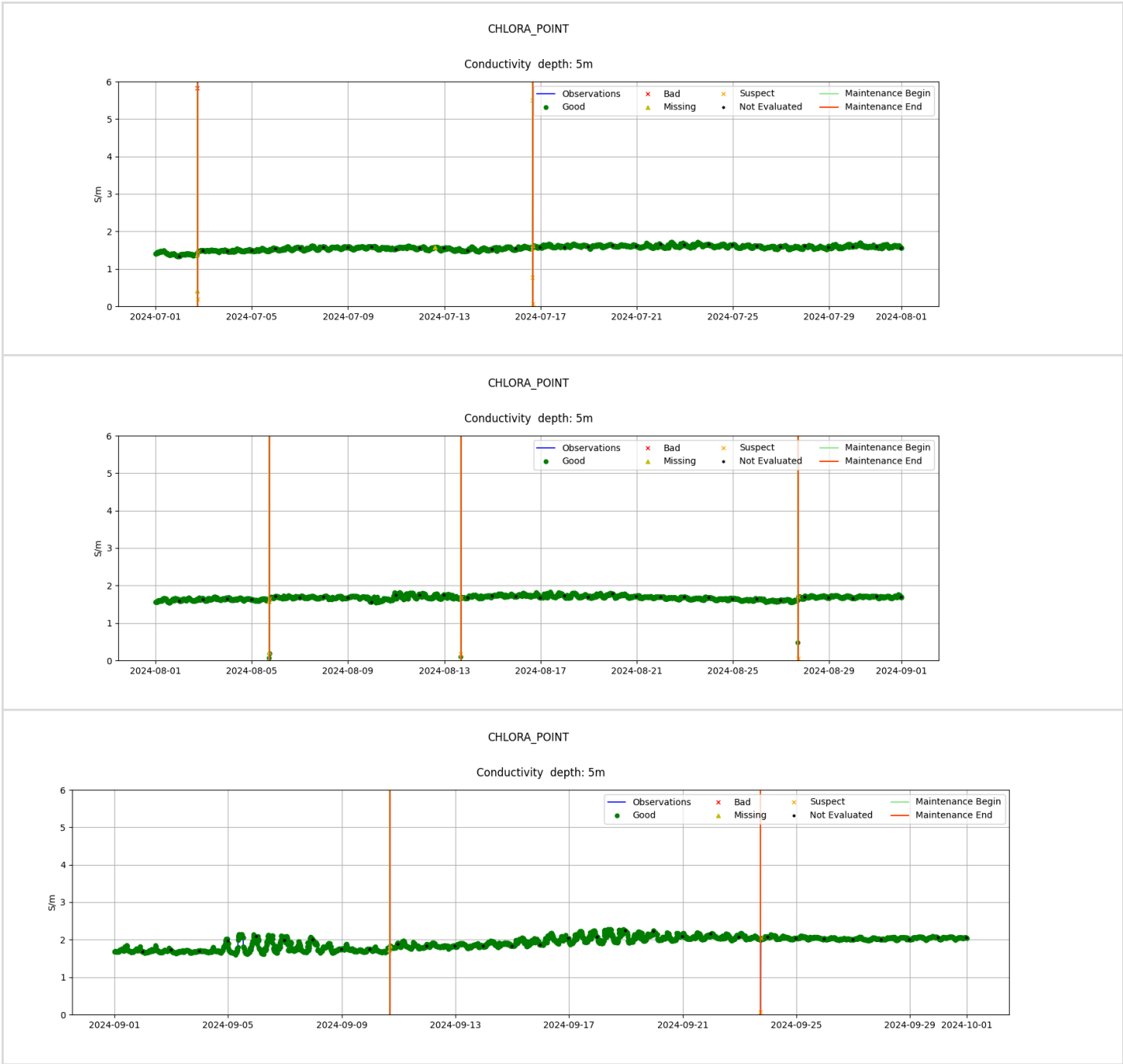


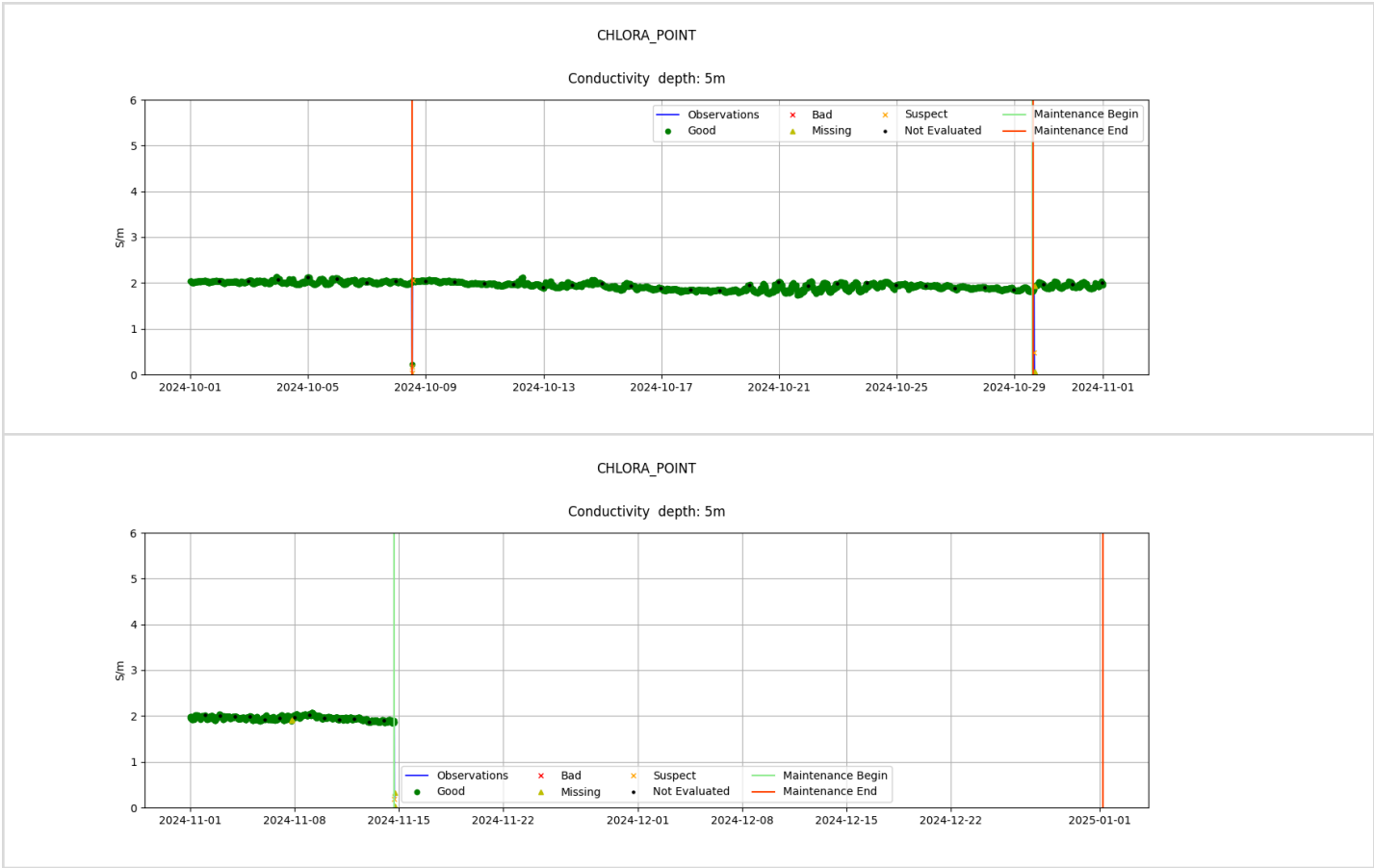


Chlora Point 5m Conductivity

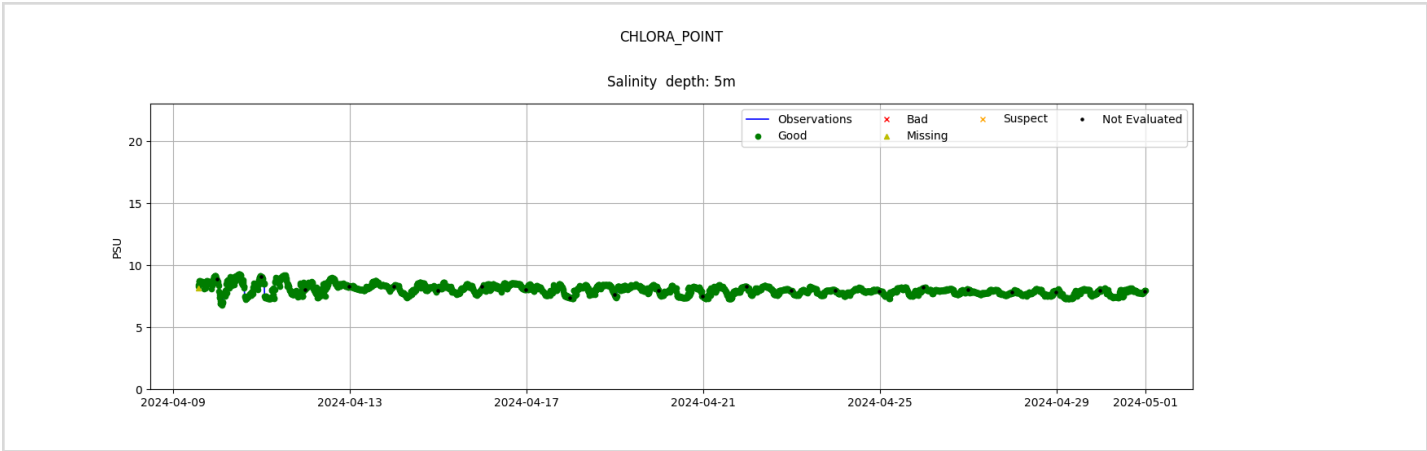


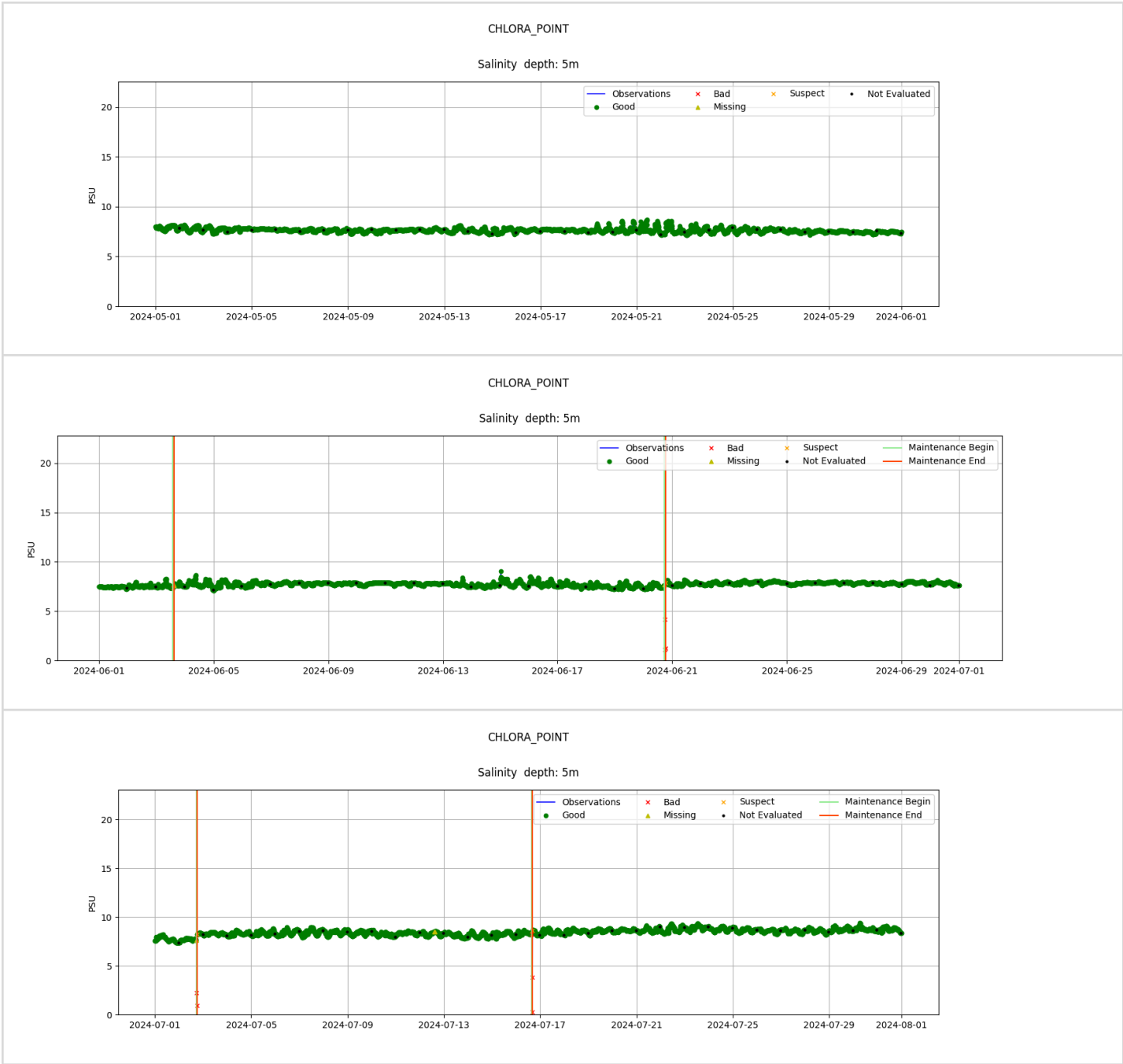


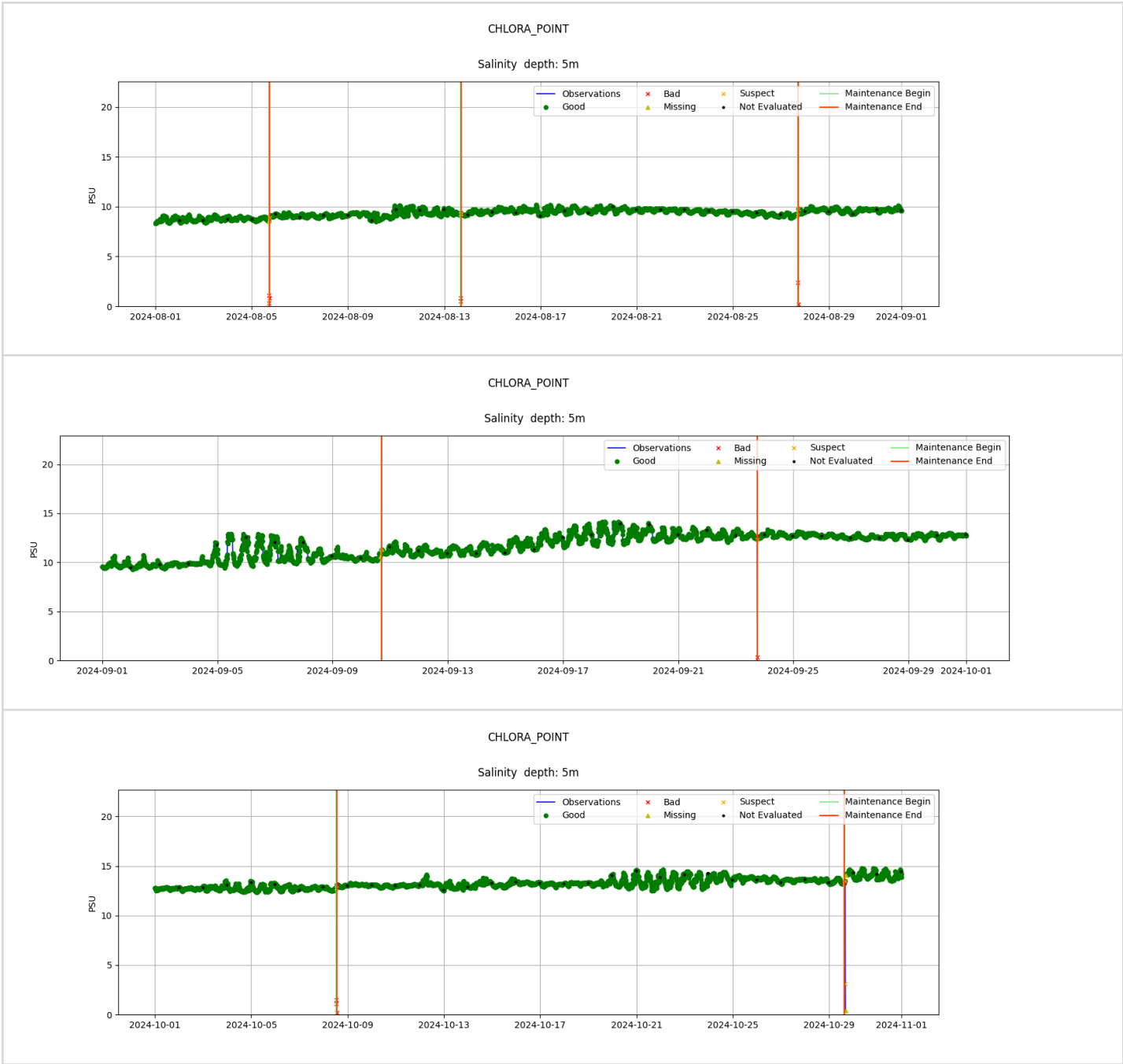


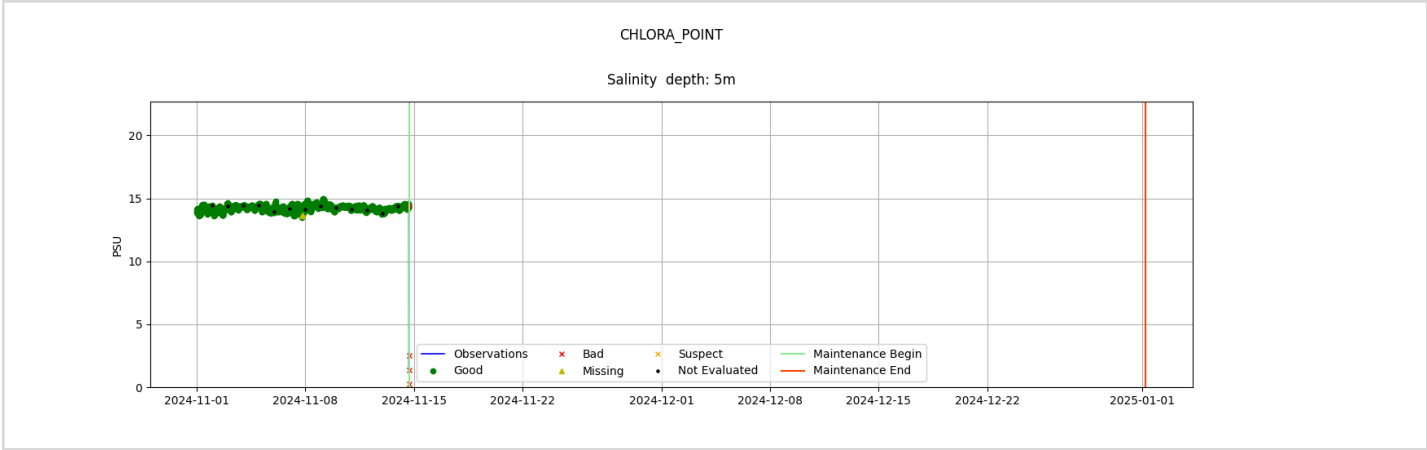


Chlora Point 5m Salinity

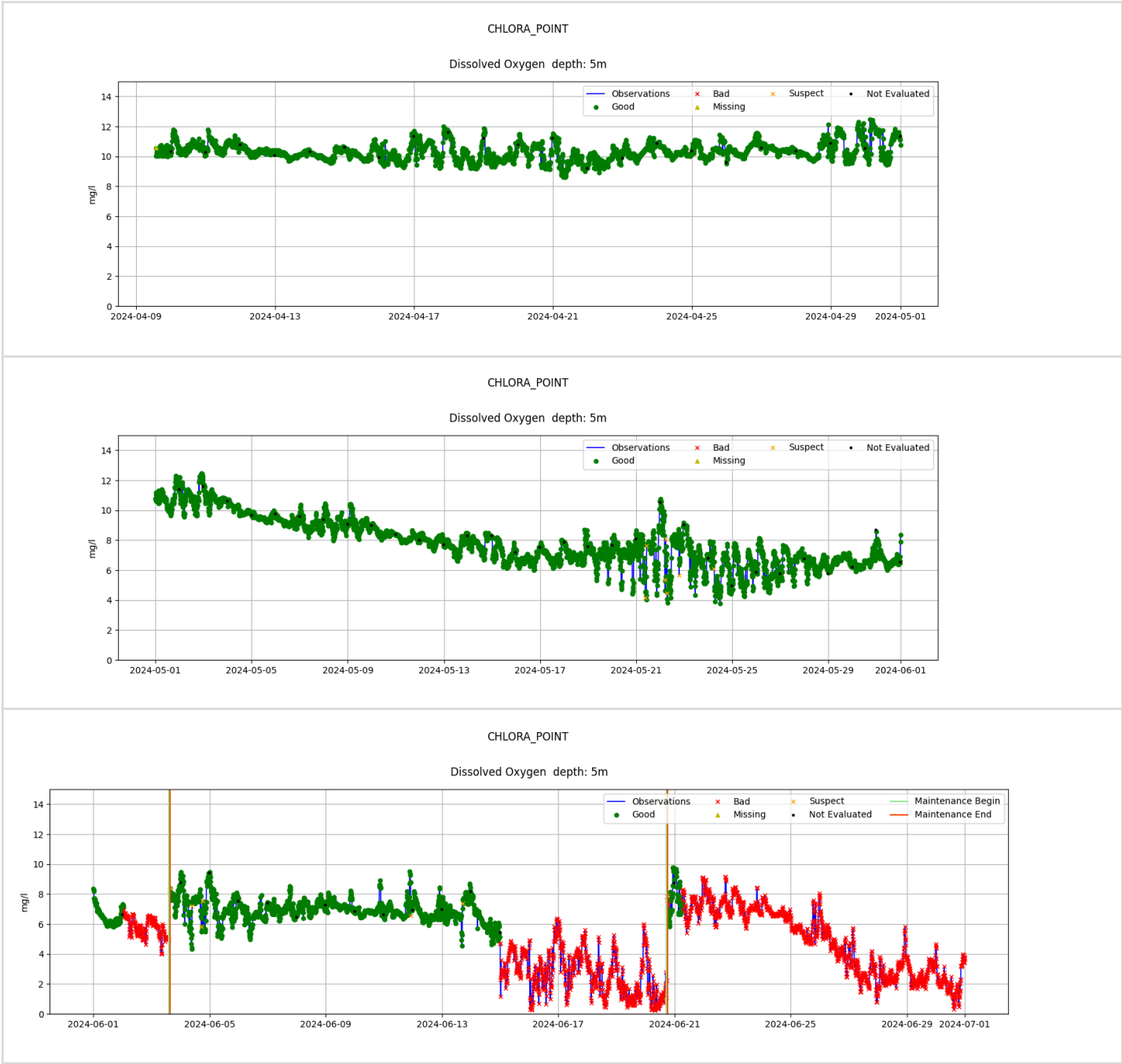


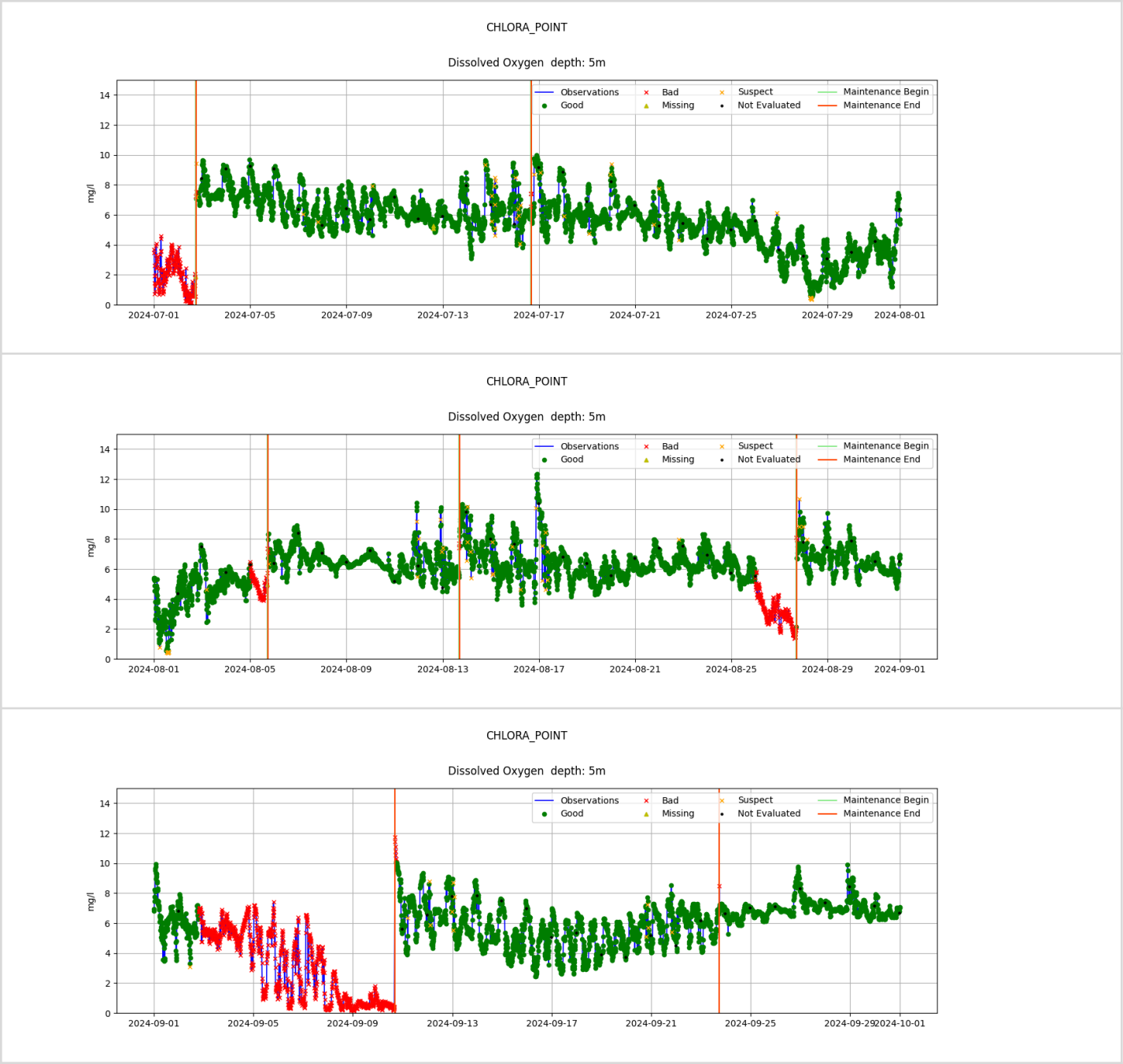






Chlora Point 5m Dissolved Oxygen

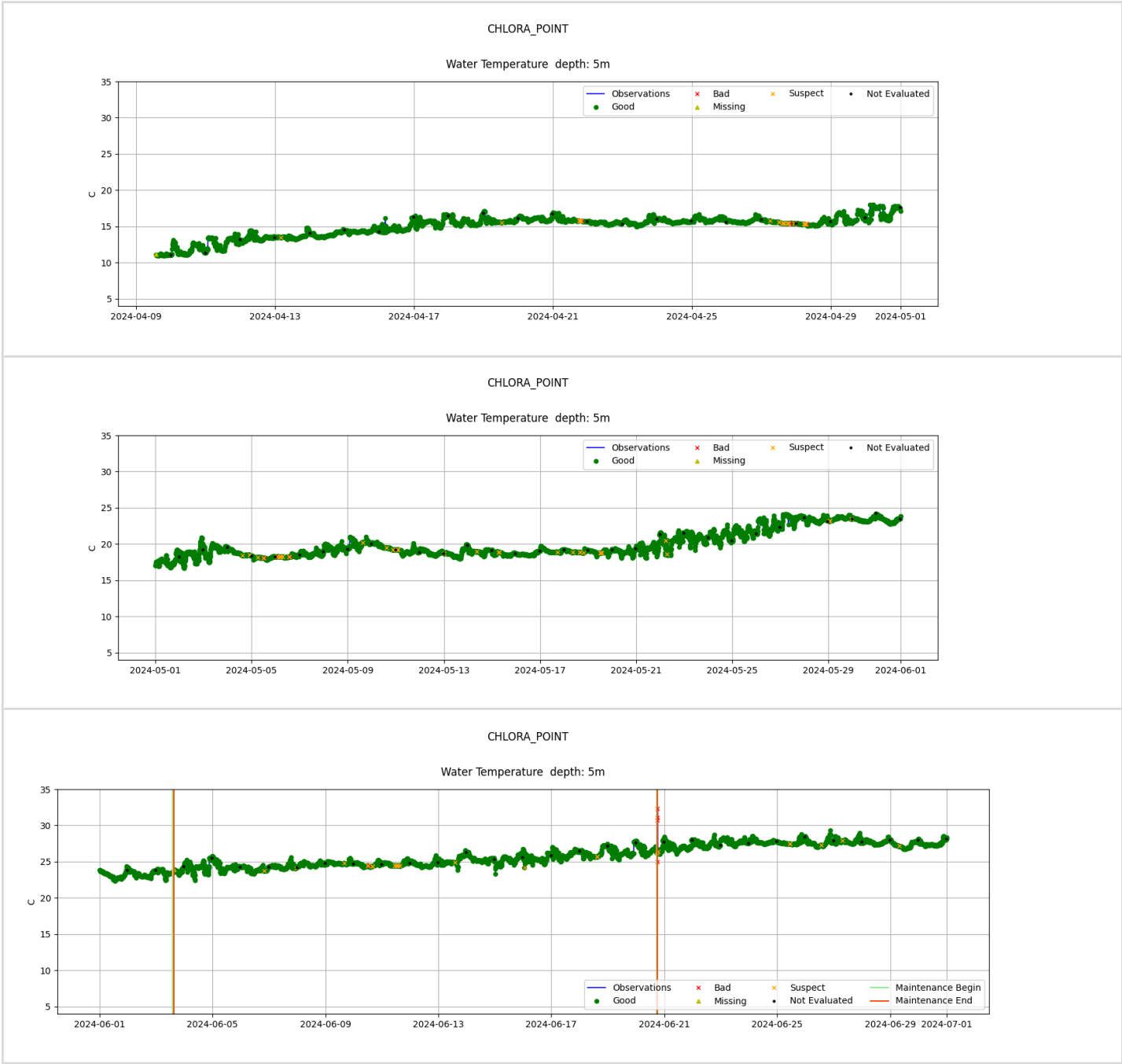








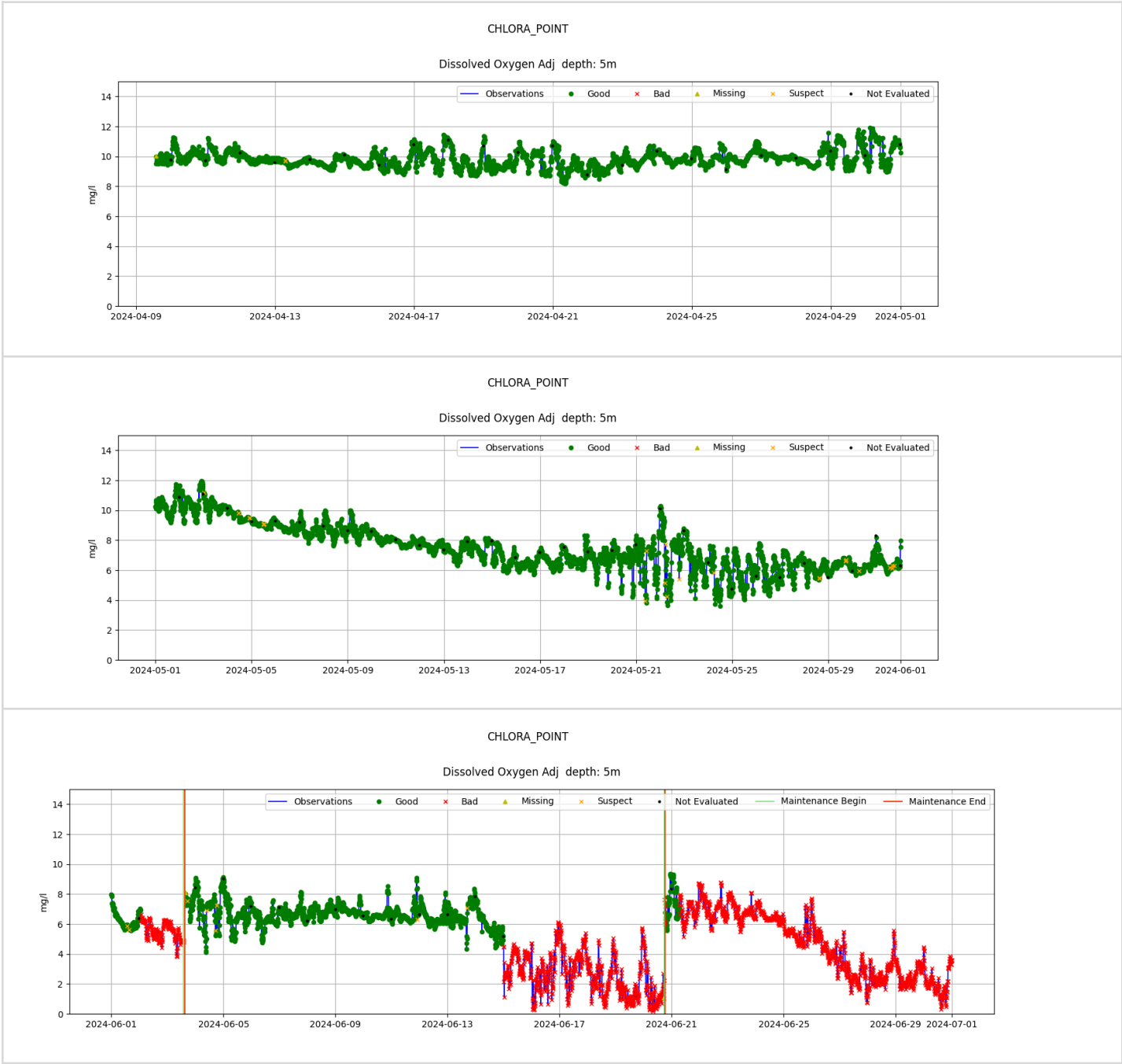
Chlora Point 5m Water Temperature

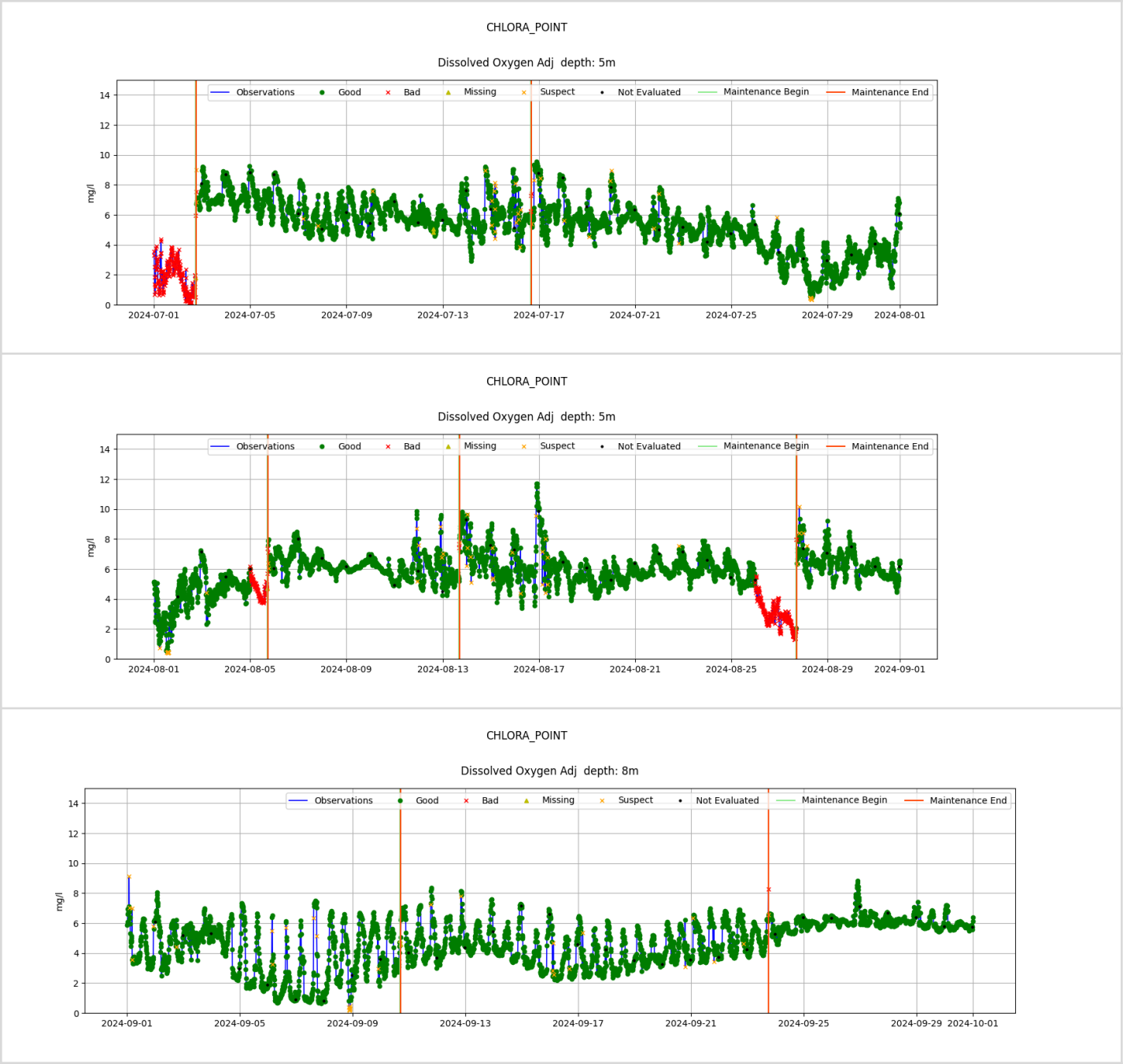






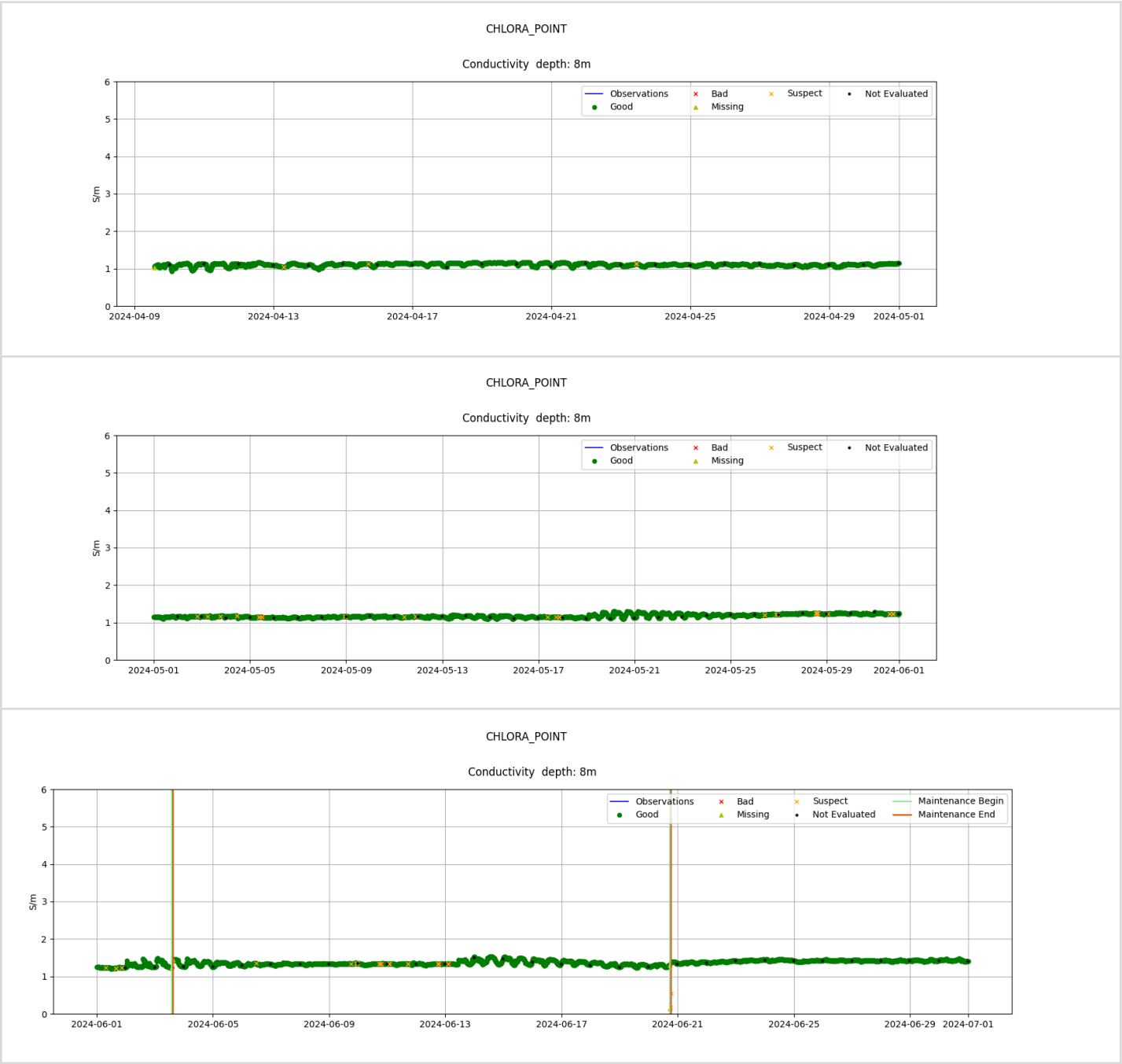
Chlora Point 5m Dissolved Oxygen Adjusted

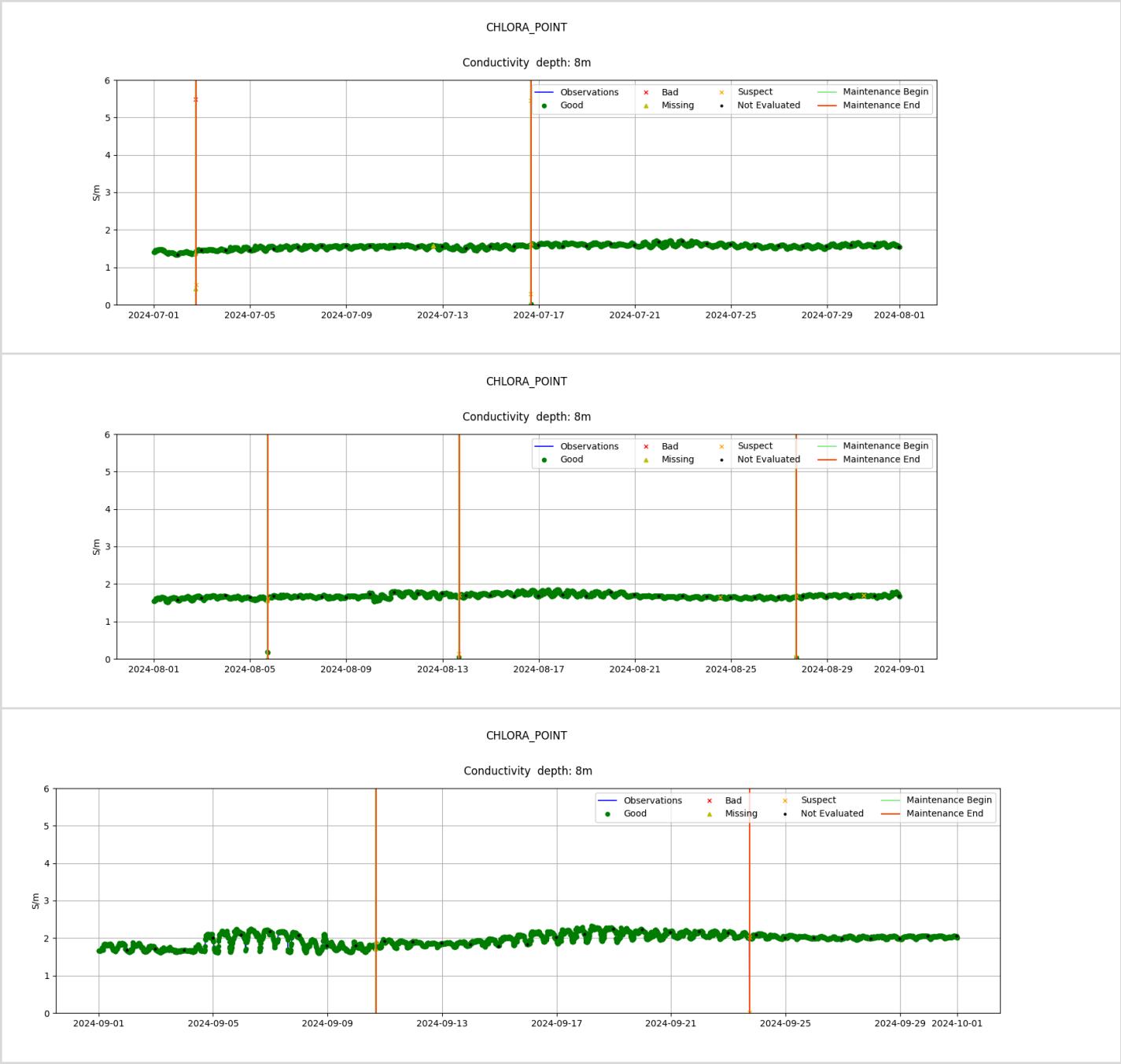






Chlora Point 8m Conductivity

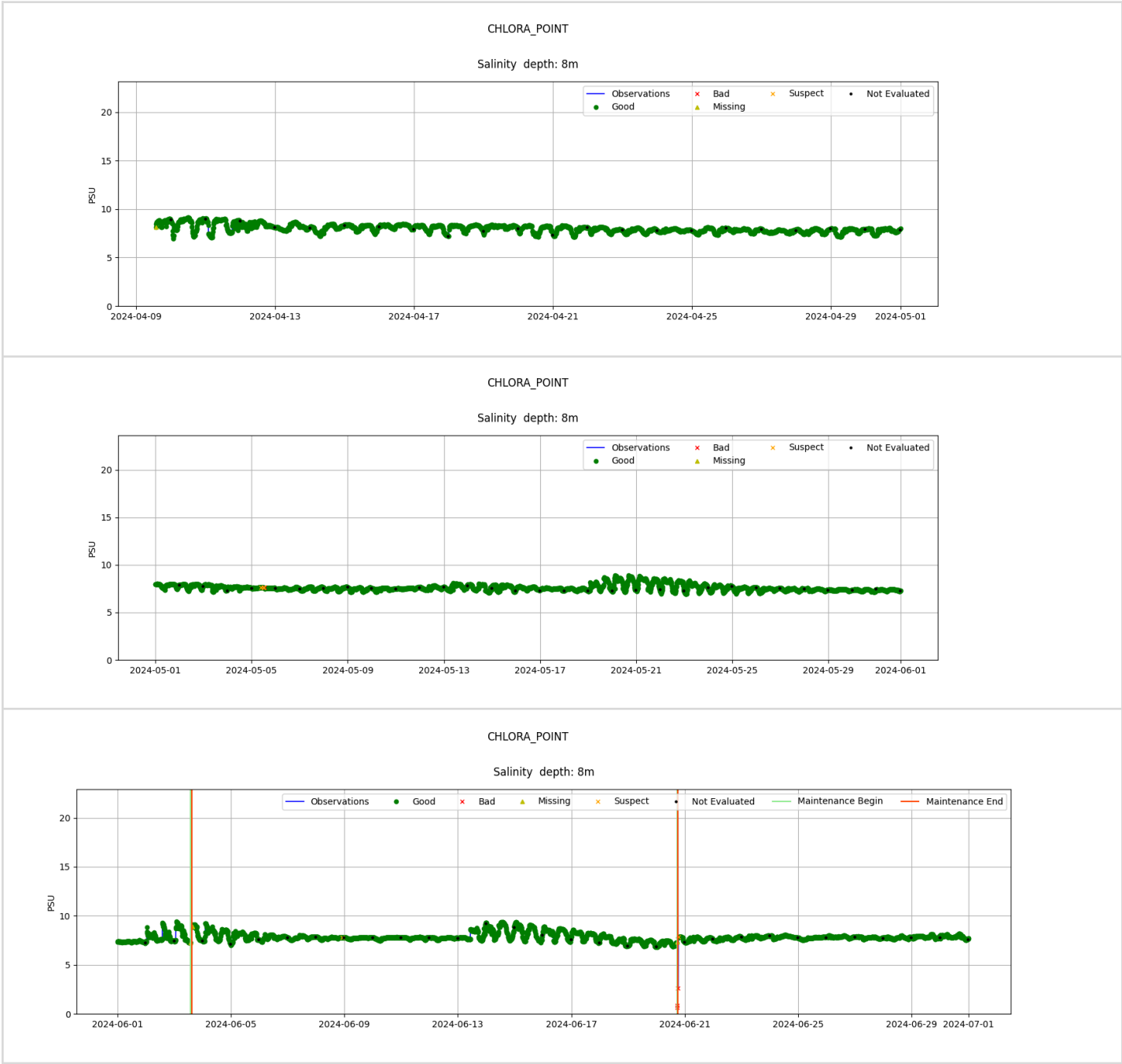


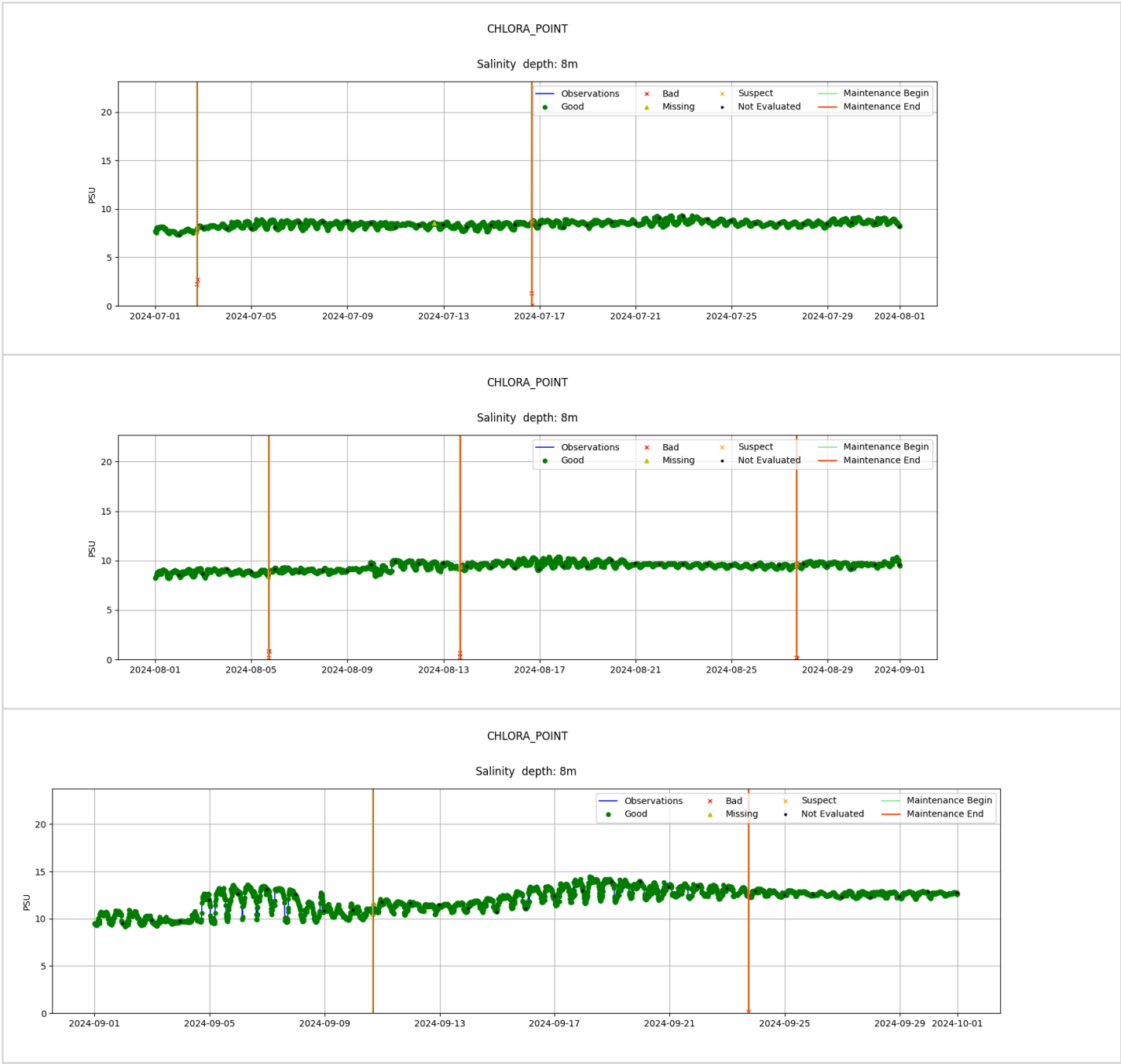






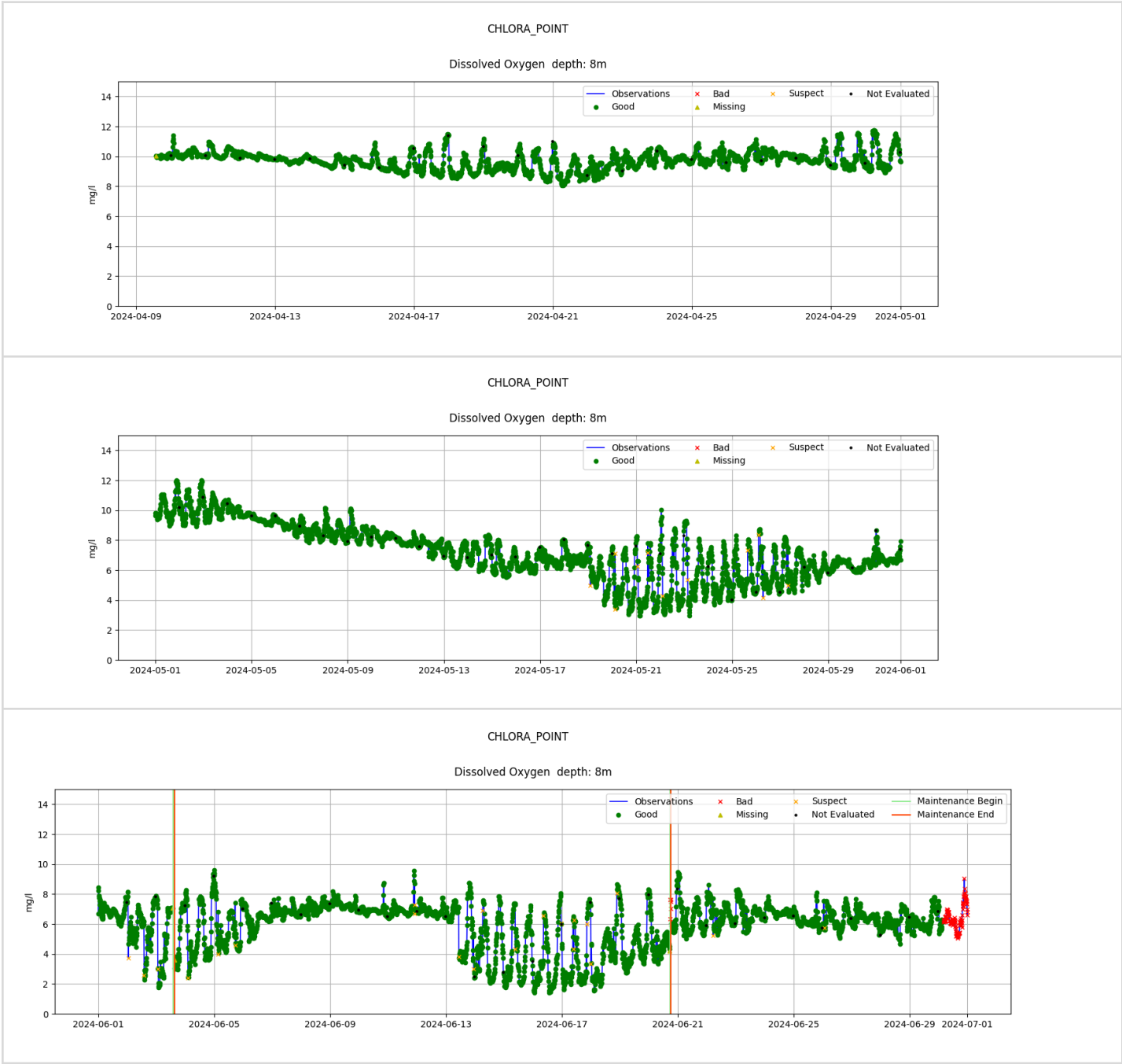
Chlora Point 8m Salinity

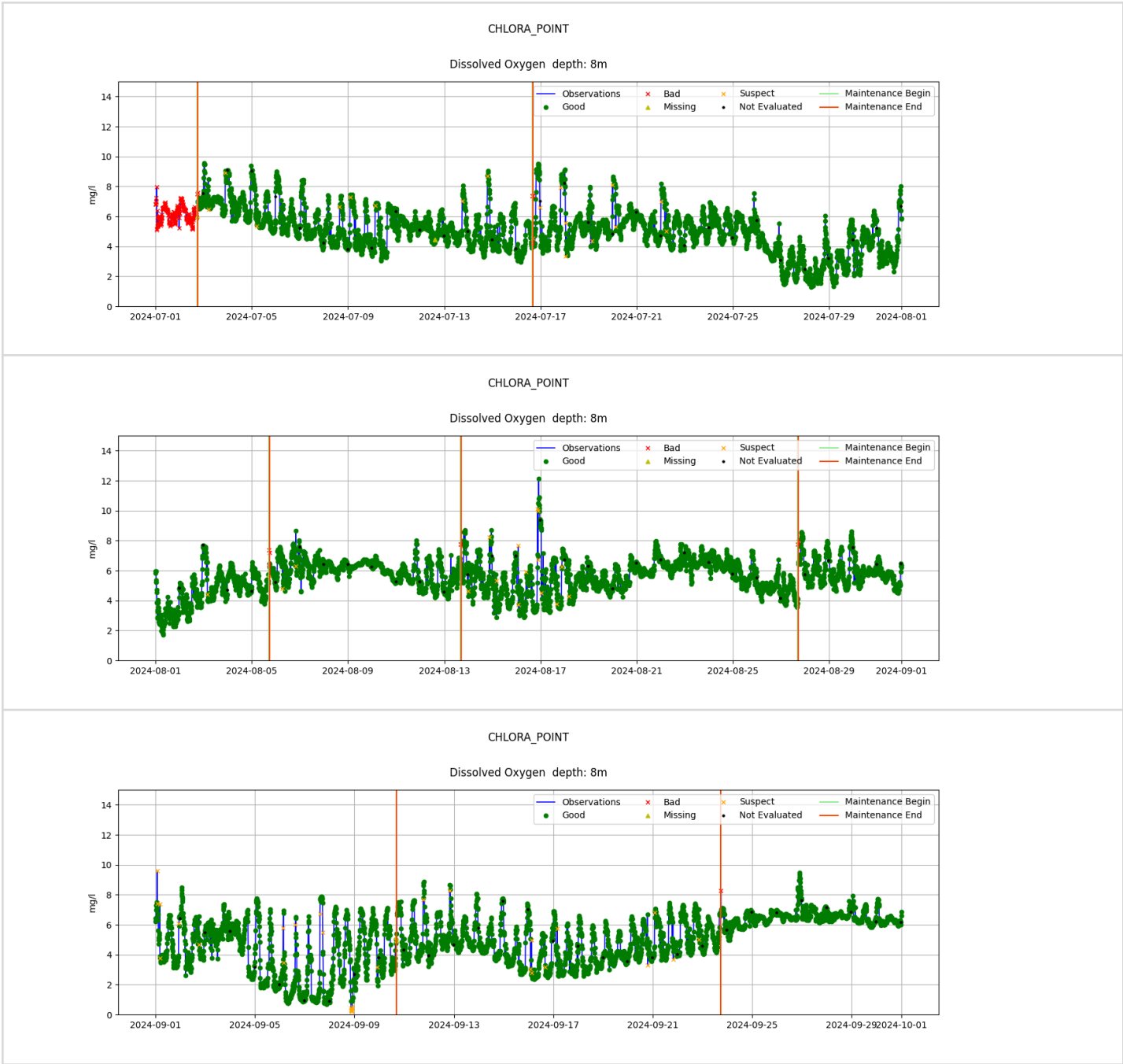






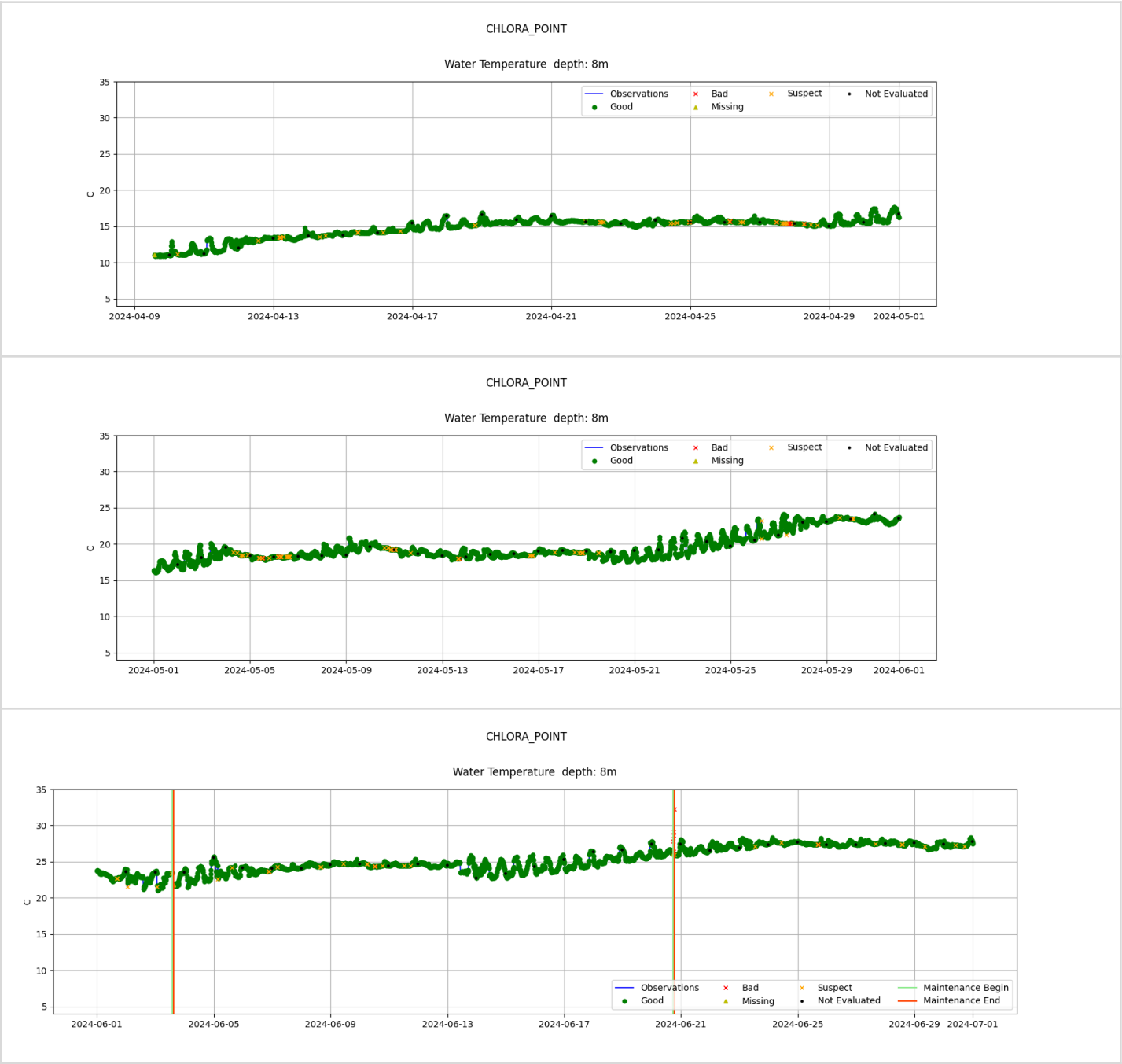
Chlora Point 8m Dissolved Oxygen



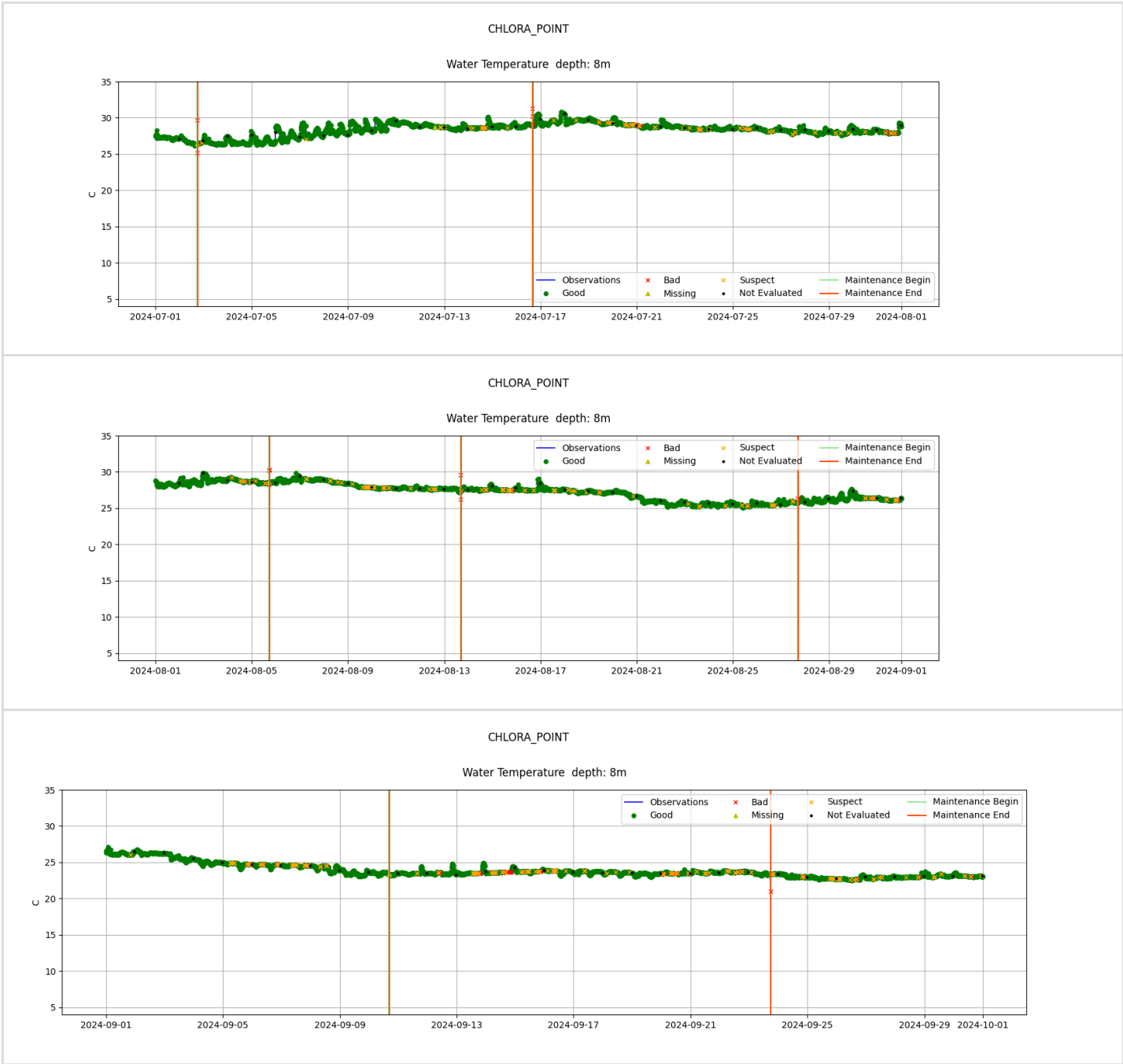


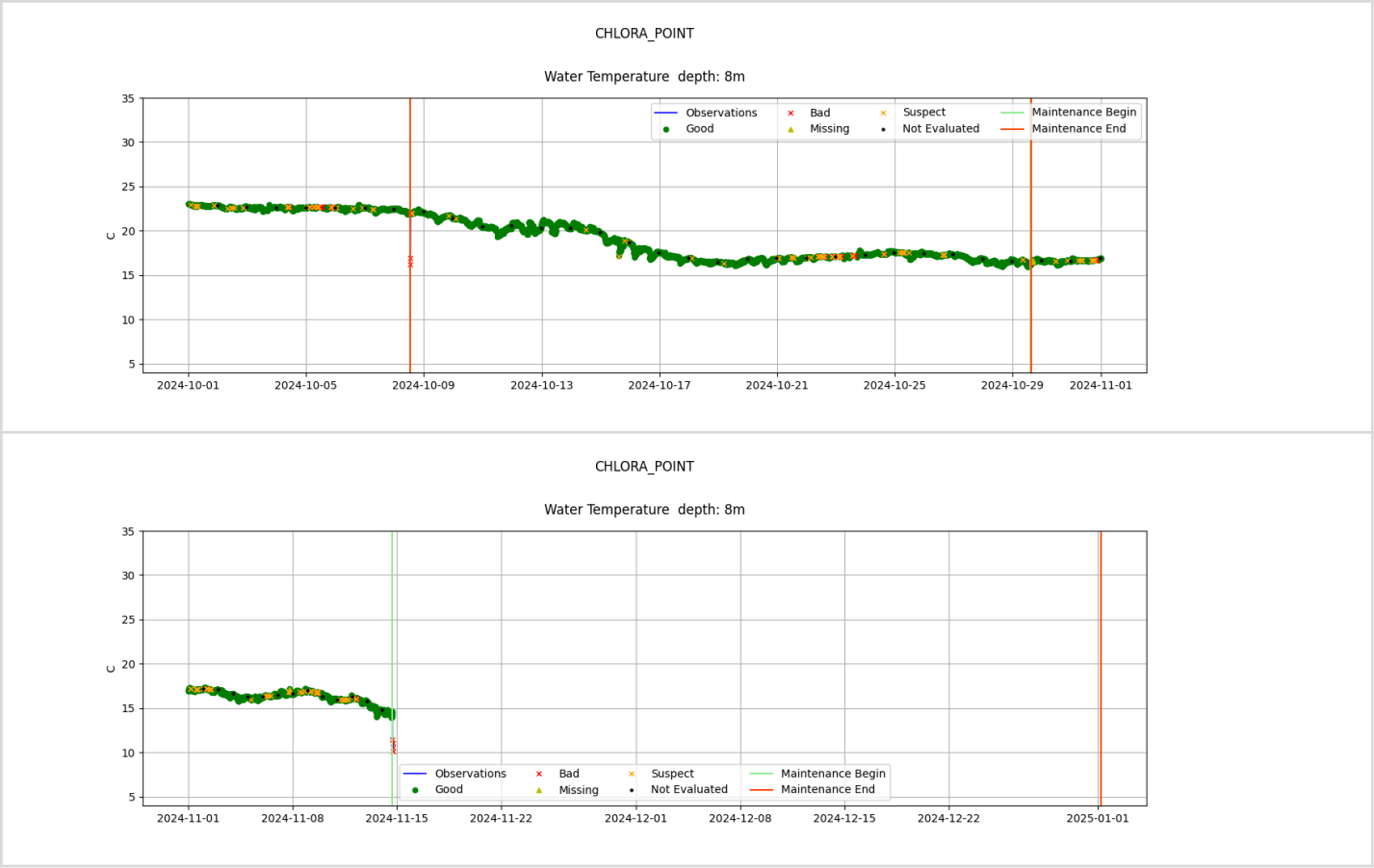


Chlora Point 8m Water Temperature









Chlora Point 2m Dissolved Oxygen Adjusted





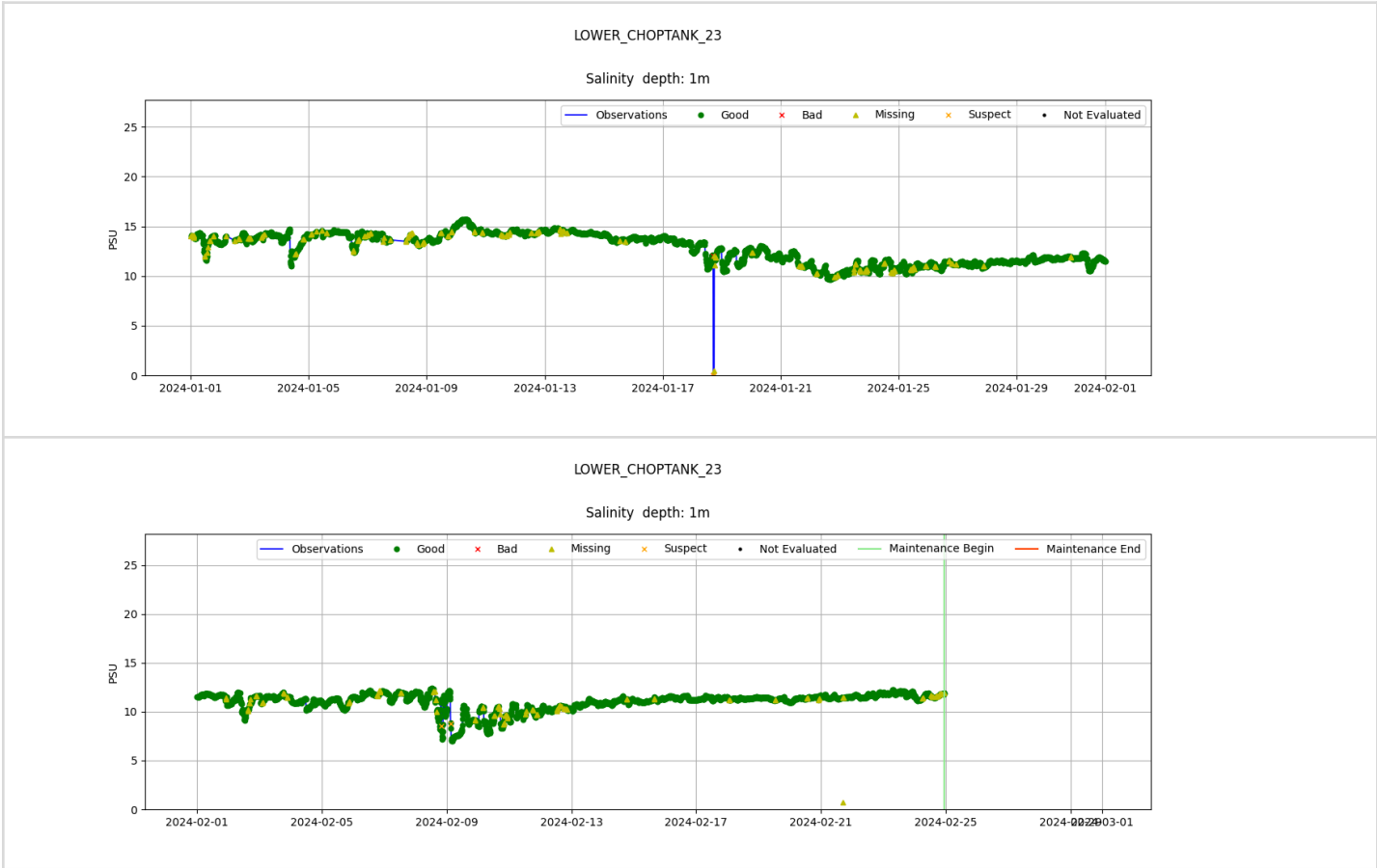


## 8.2 Lower Choptank

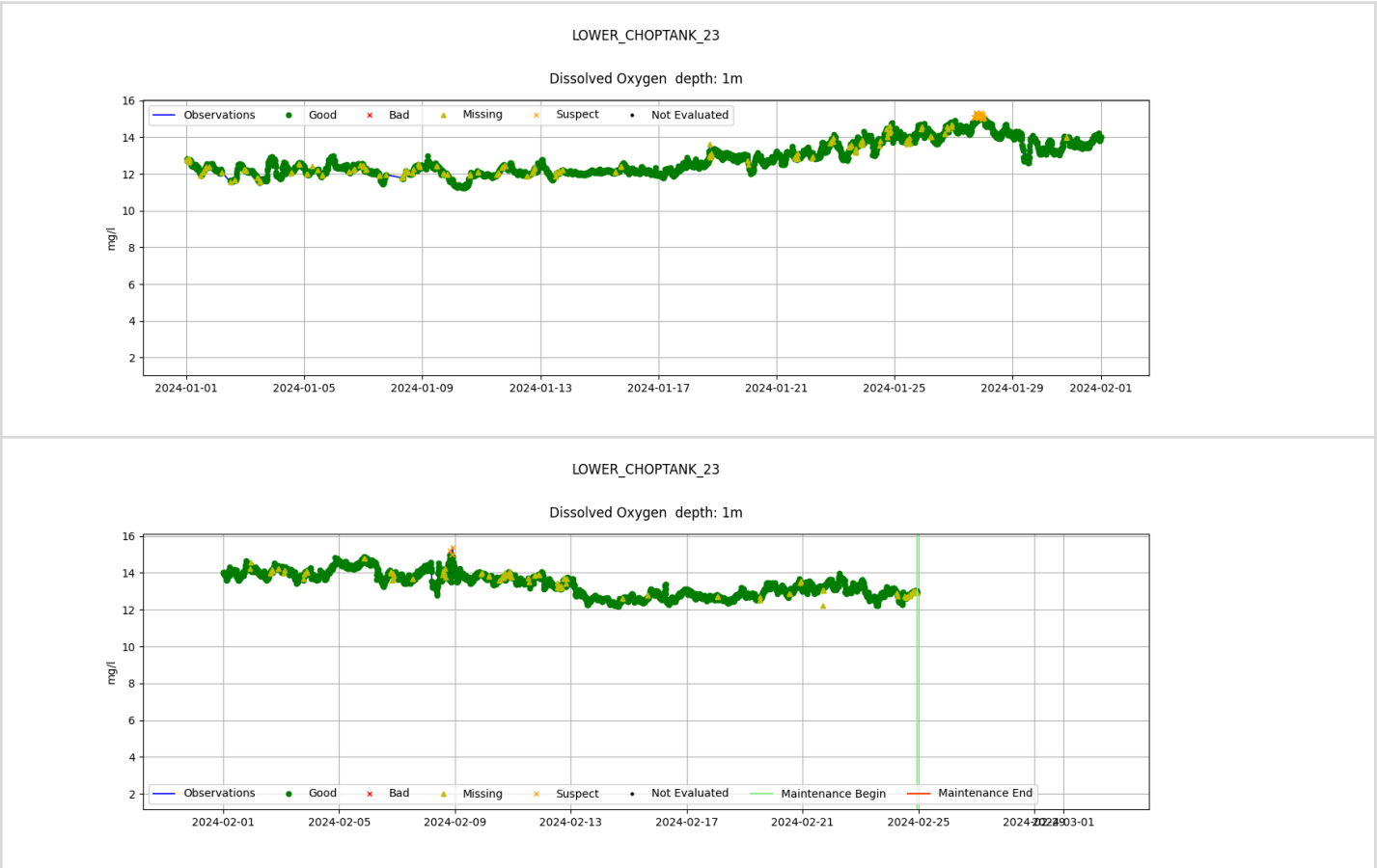
### Lower Choptank 1m Conductivity



Lower Choptank 1m Salinity

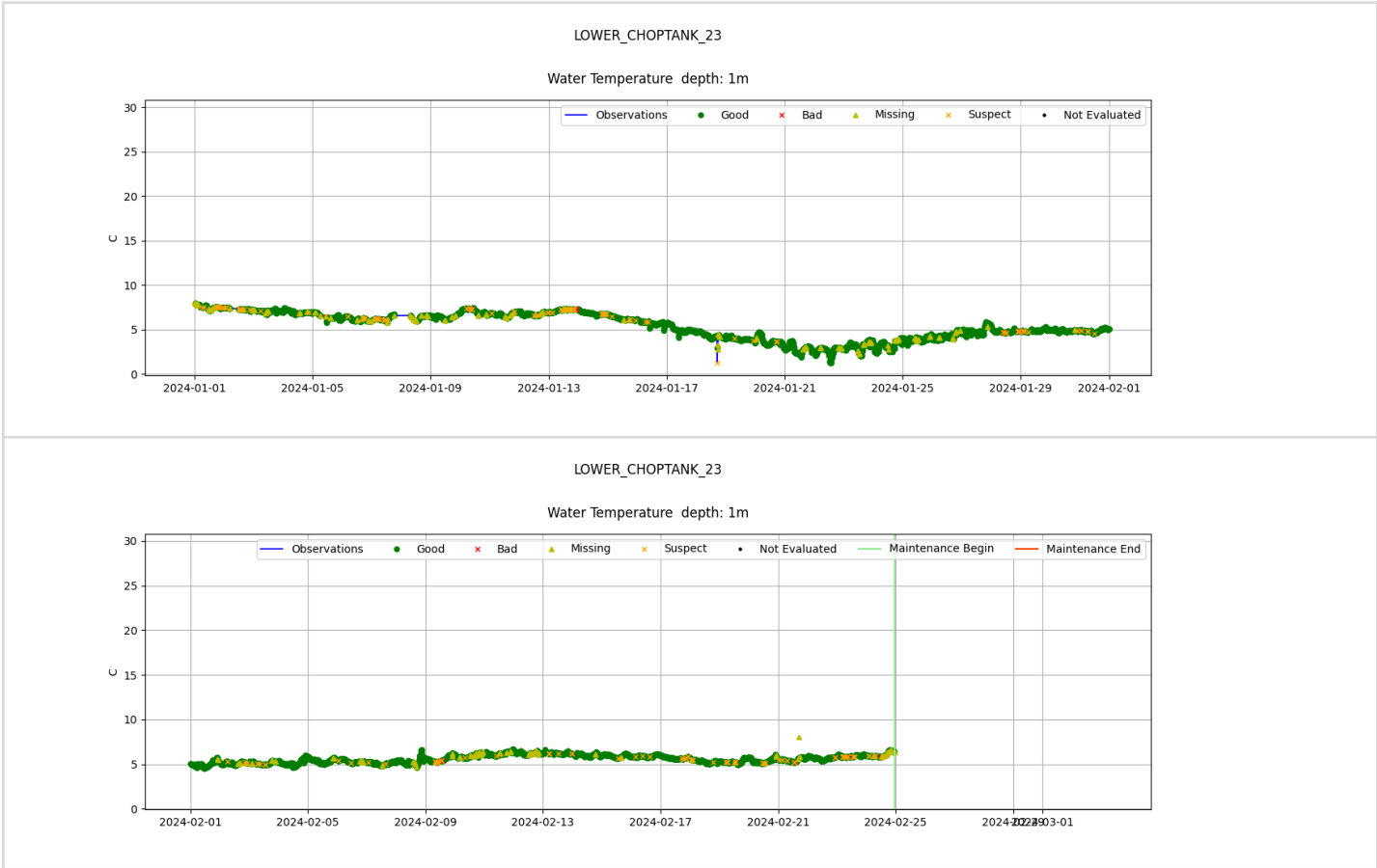


Lower Choptank 1m Dissolved Oxygen

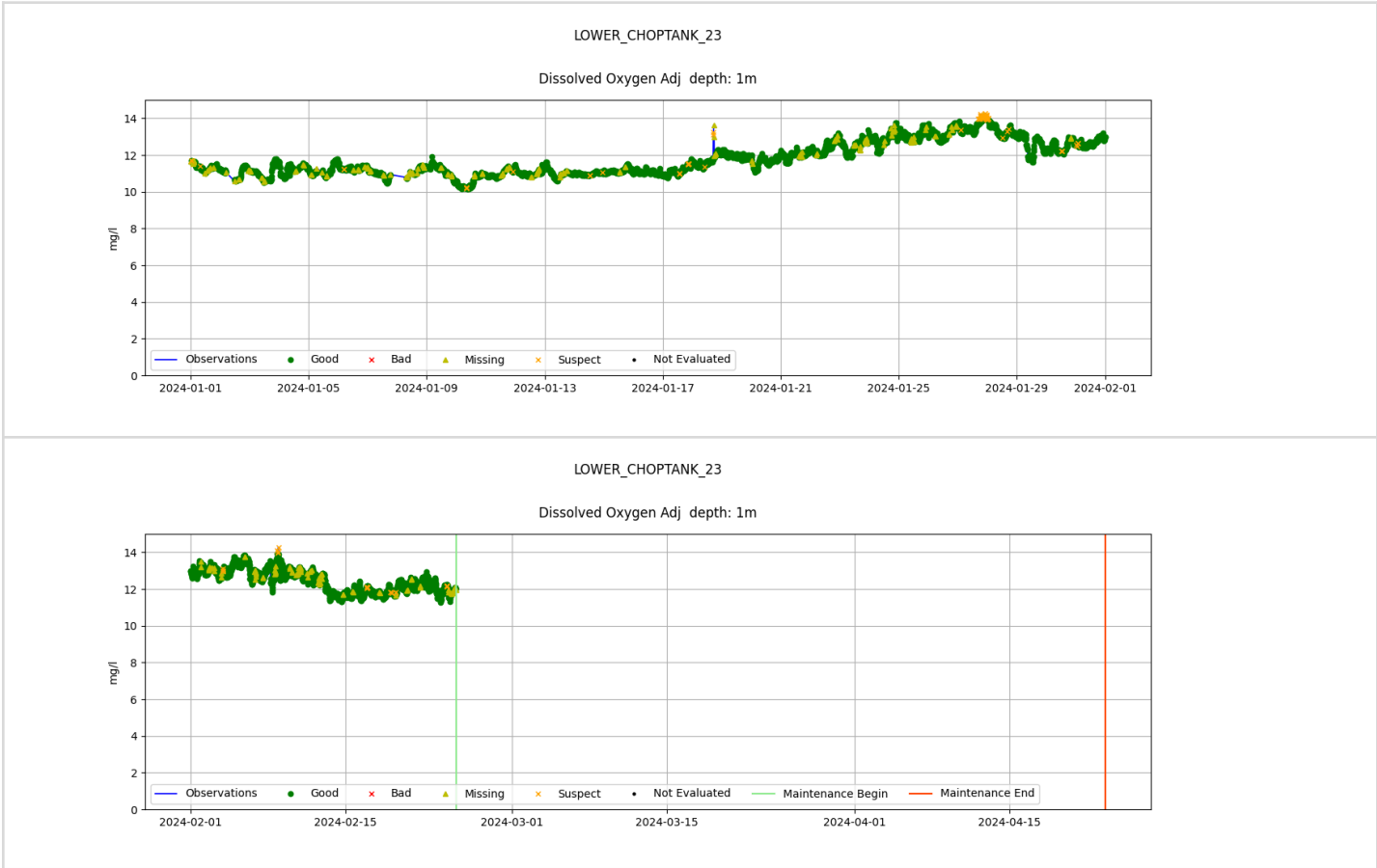




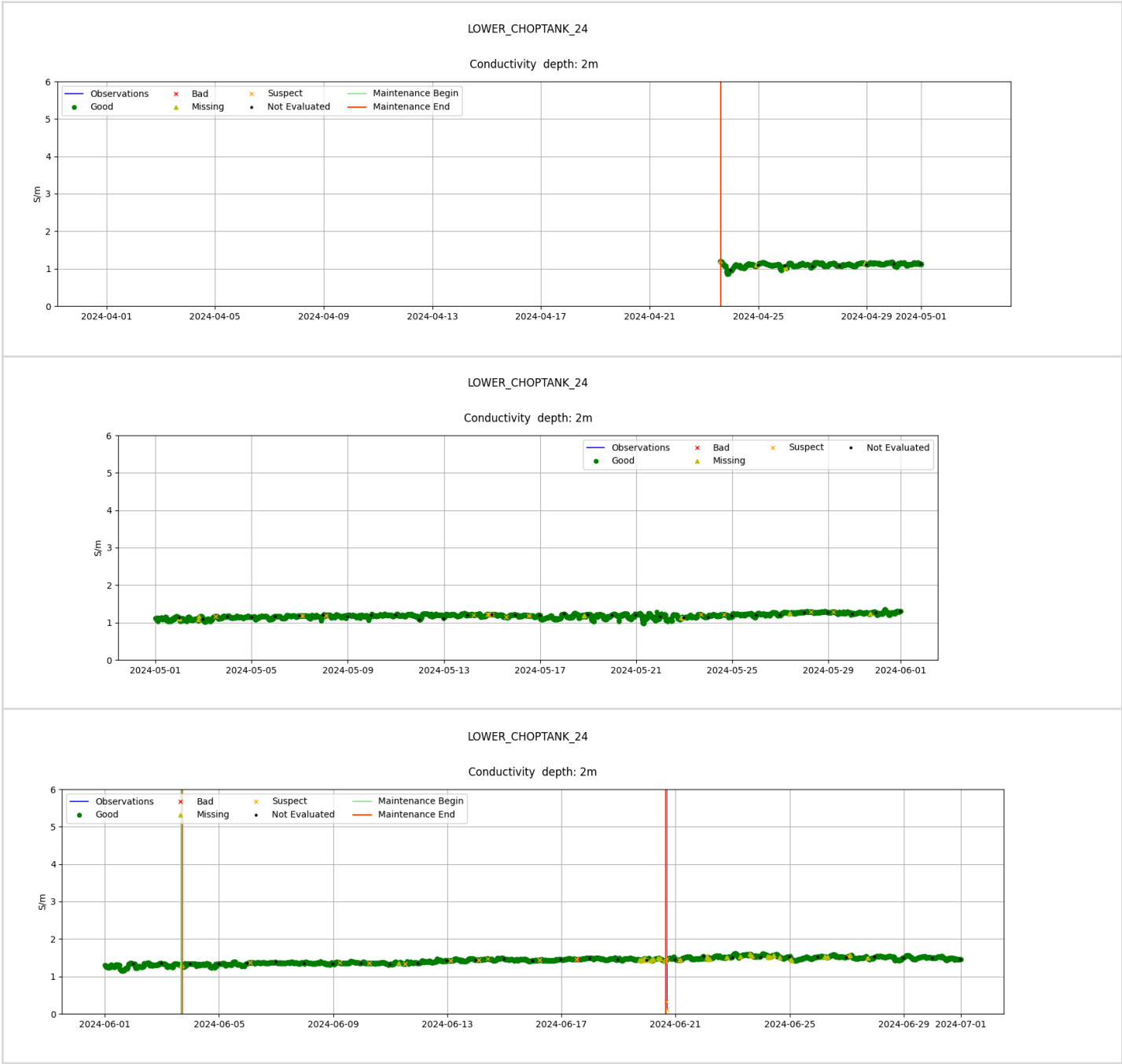
Lower Choptank 1m Water Temperature

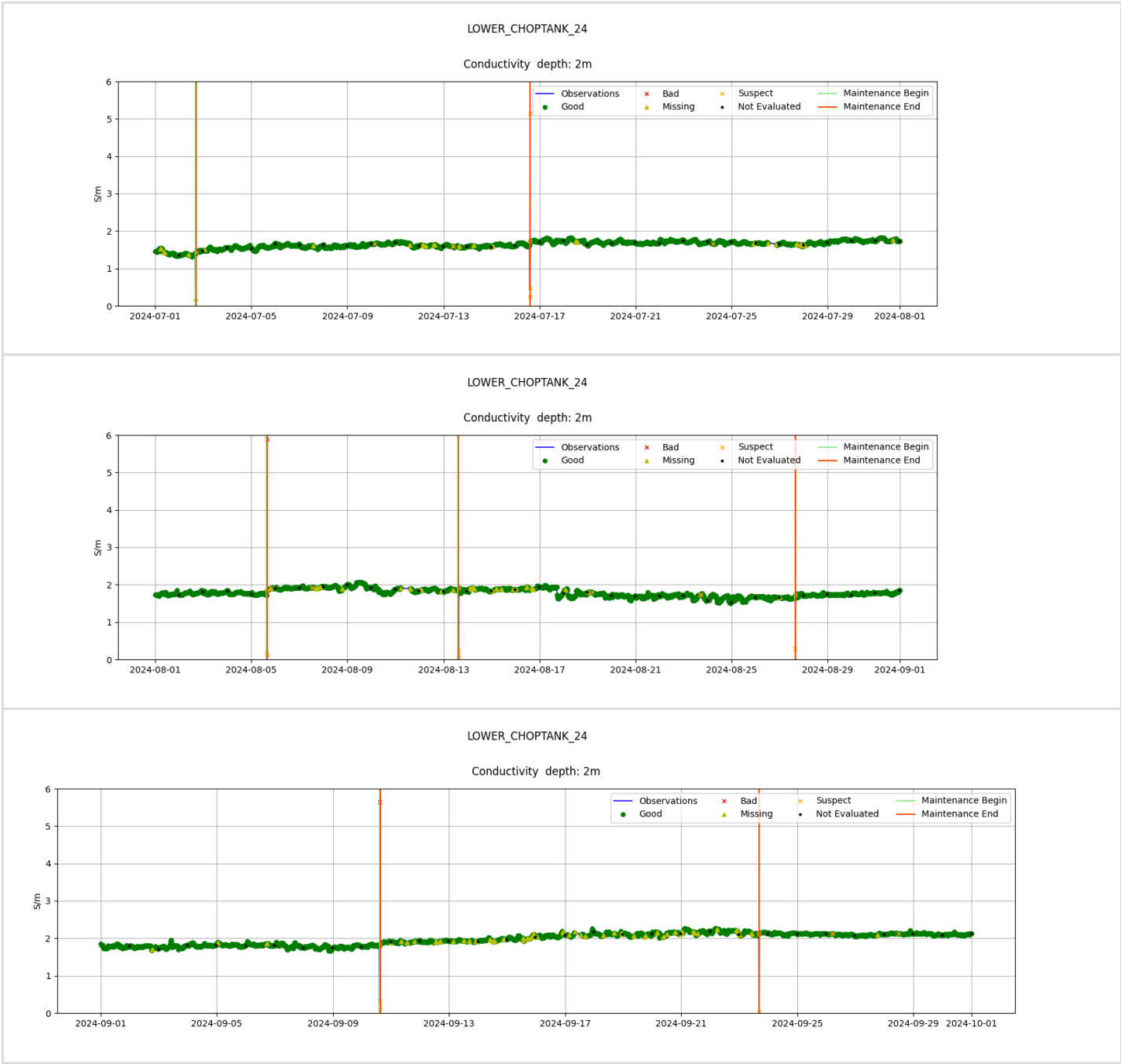


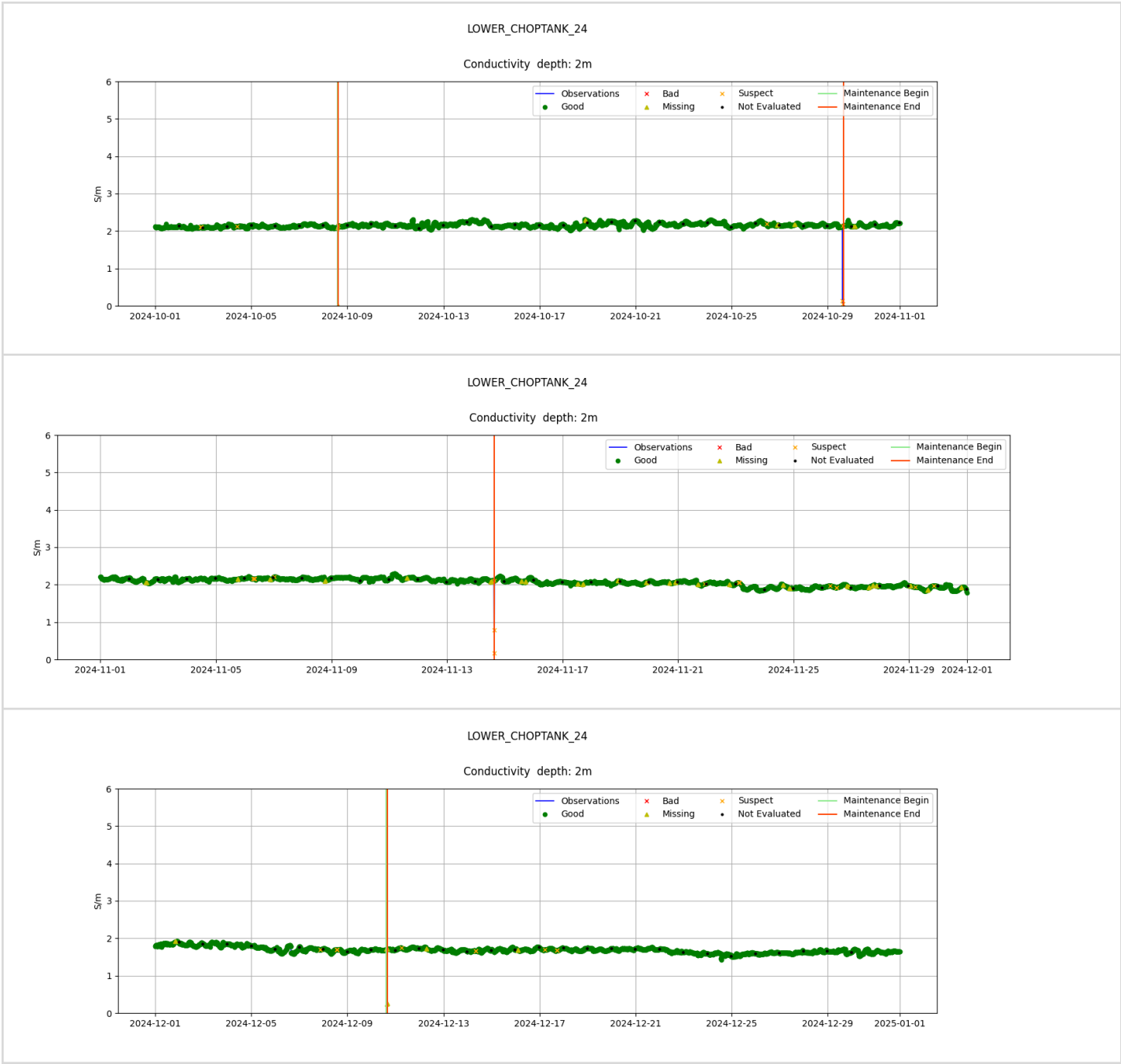
Lower Choptank 1m Dissolved Oxygen Adjusted



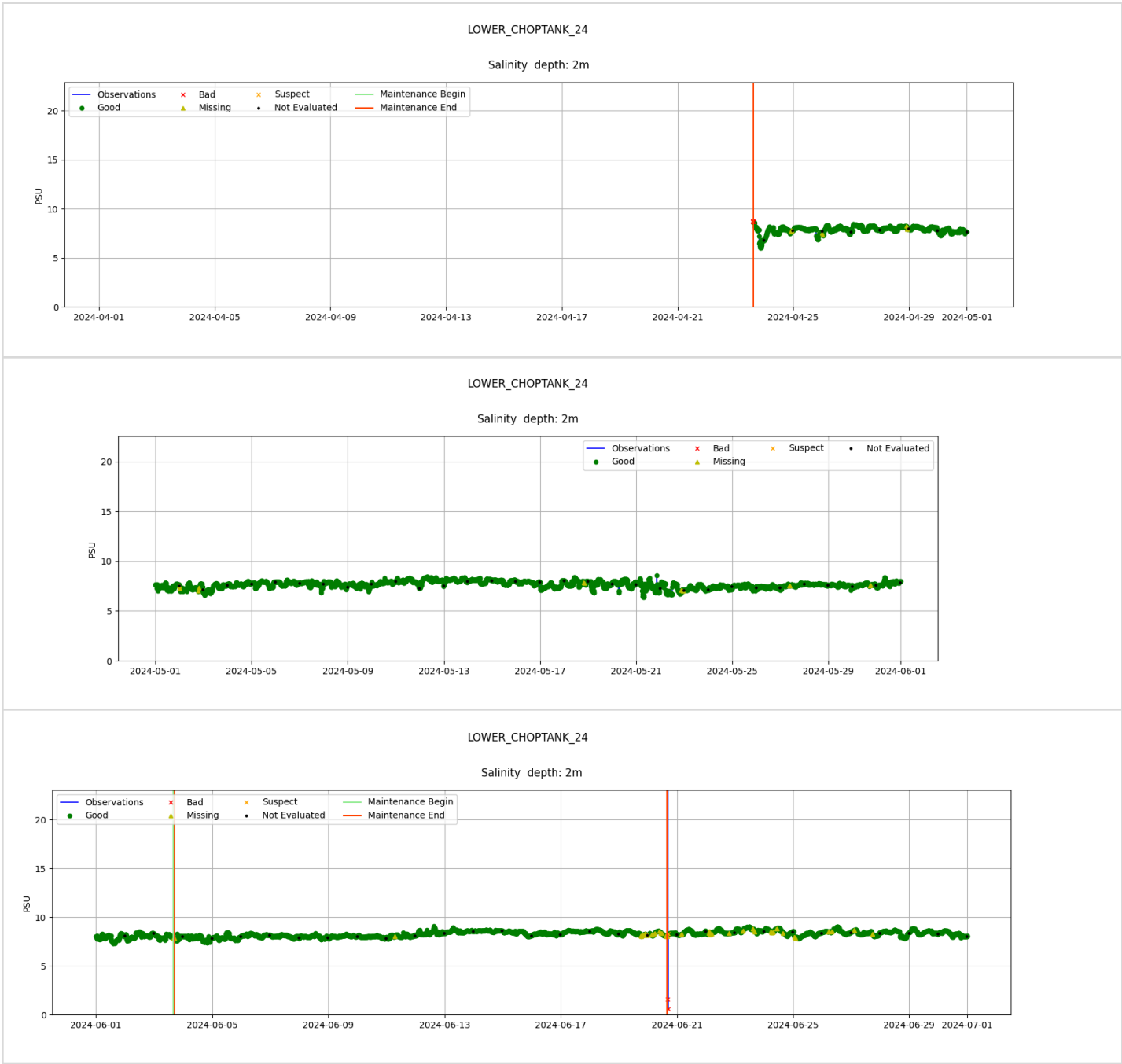
Lower Choptank 2m Conductivity

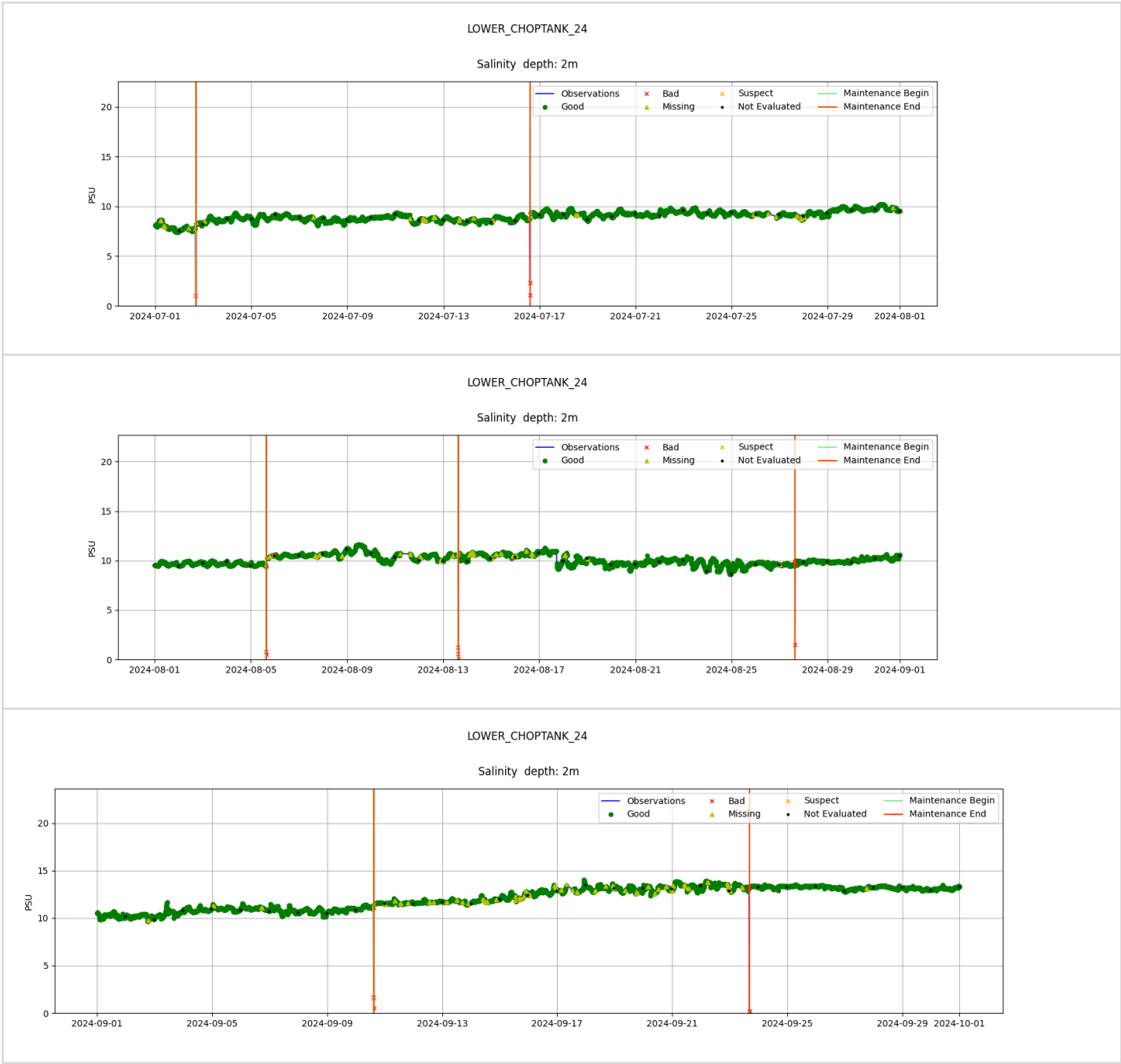


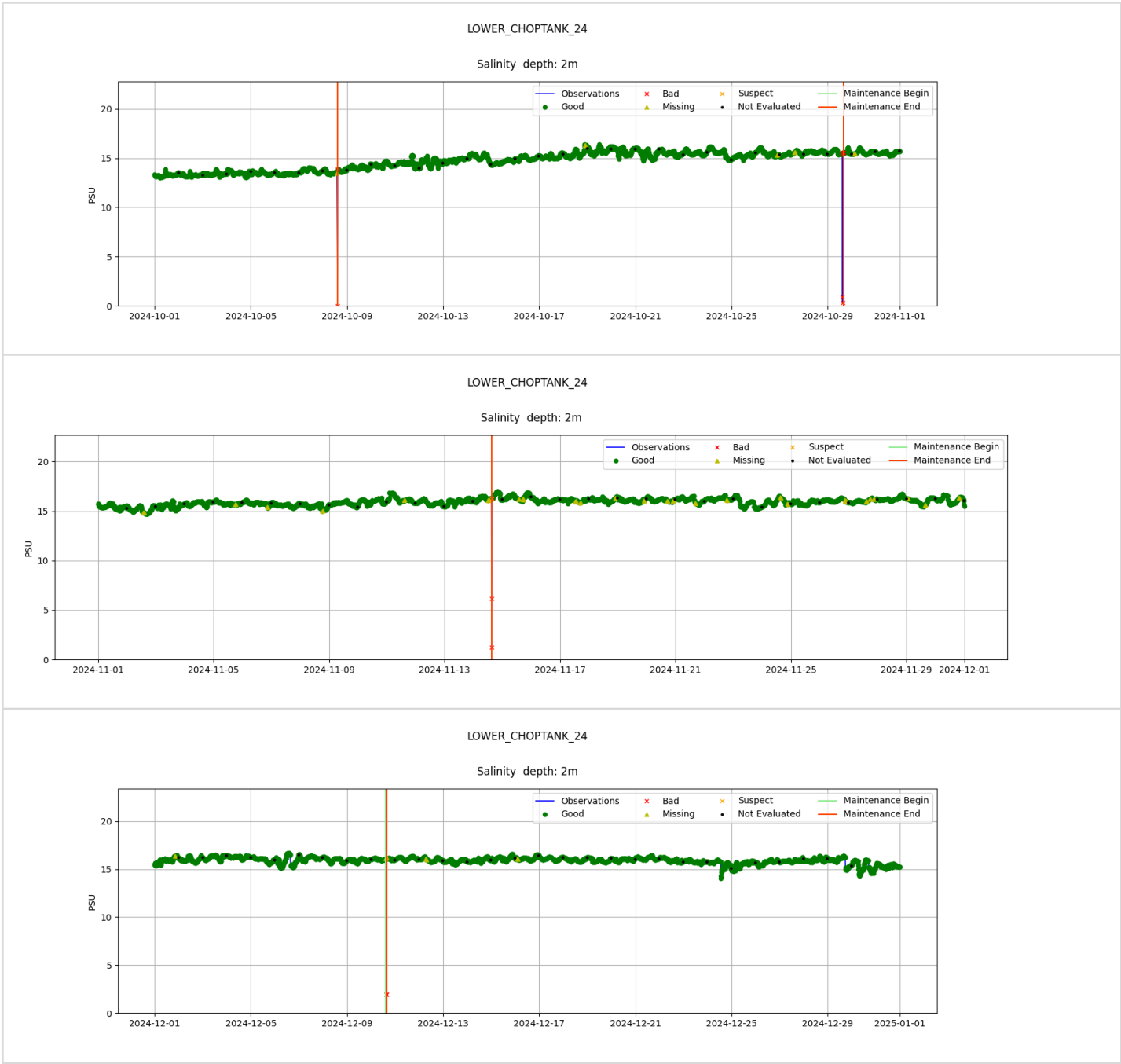




Lower Choptank 2m Salinity



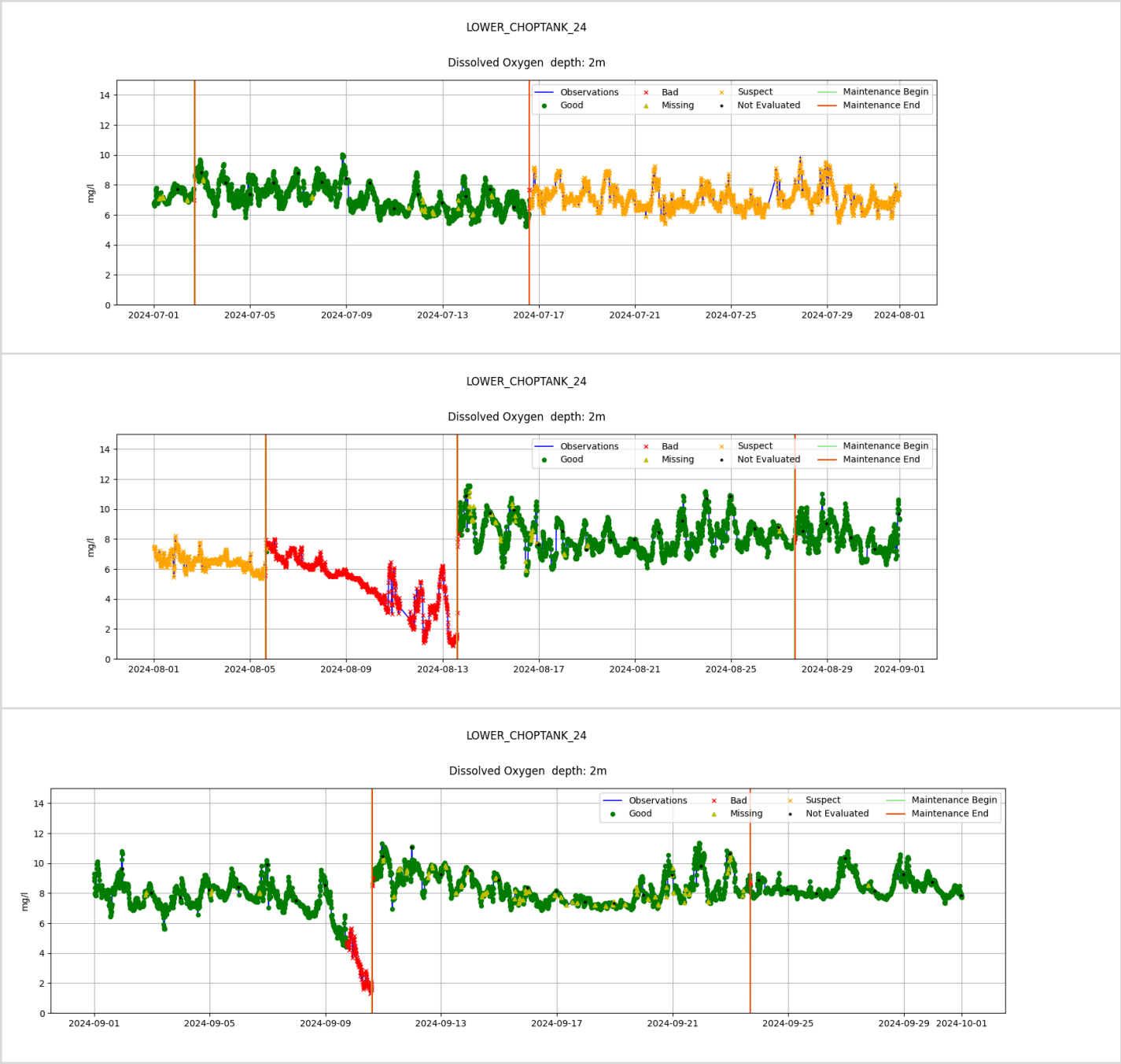


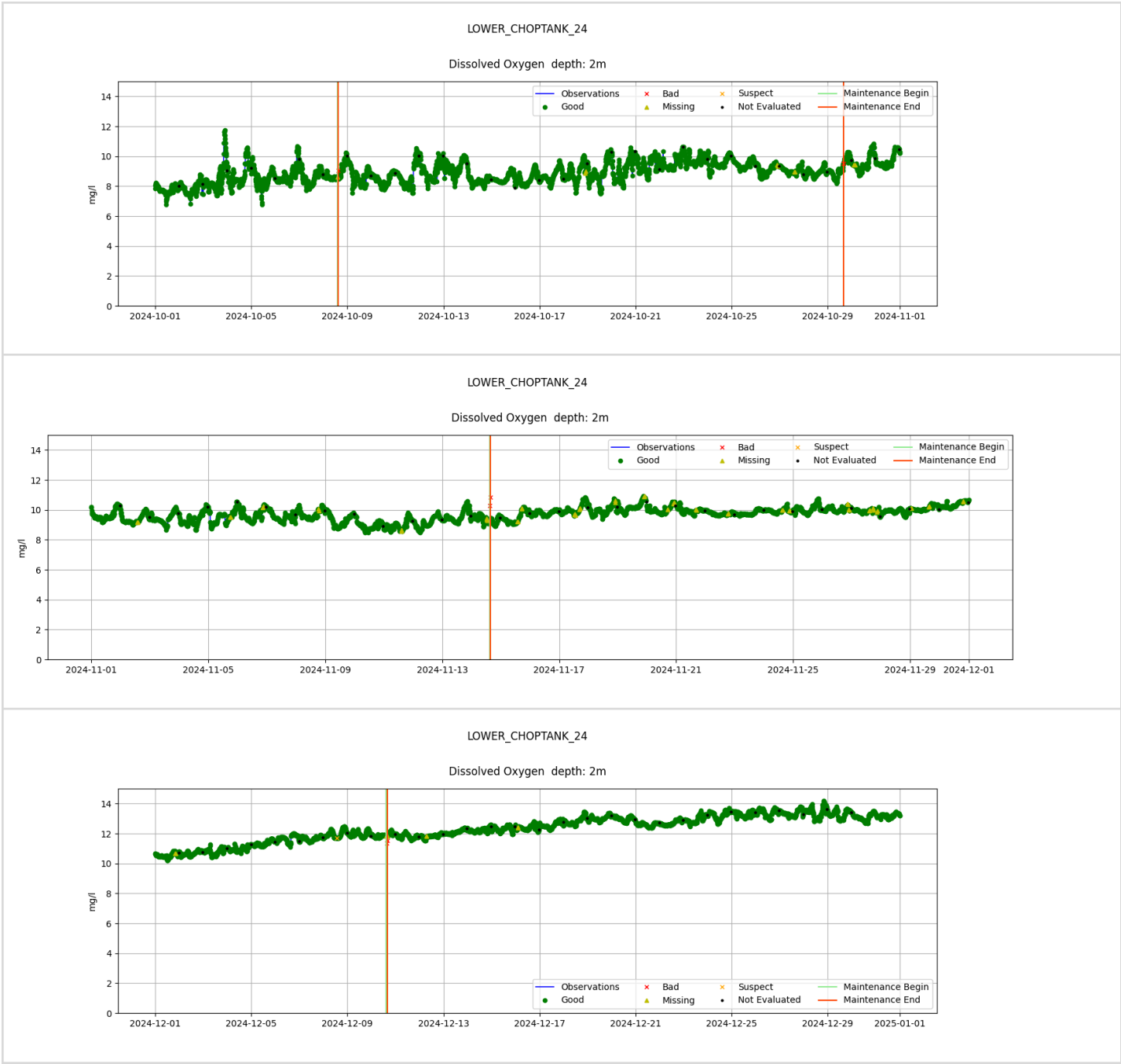




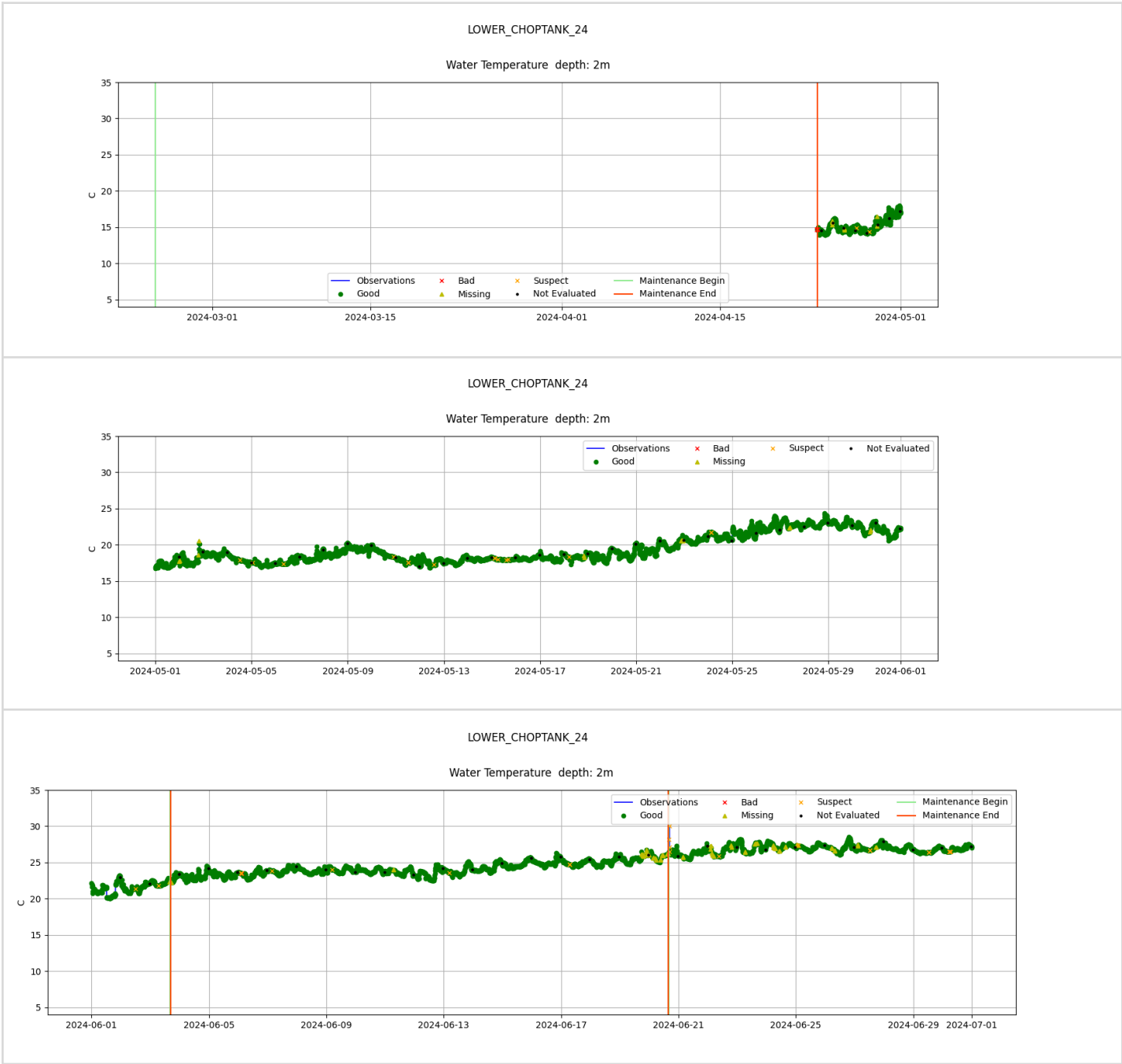
Lower Choptank 2m Dissolved Oxygen



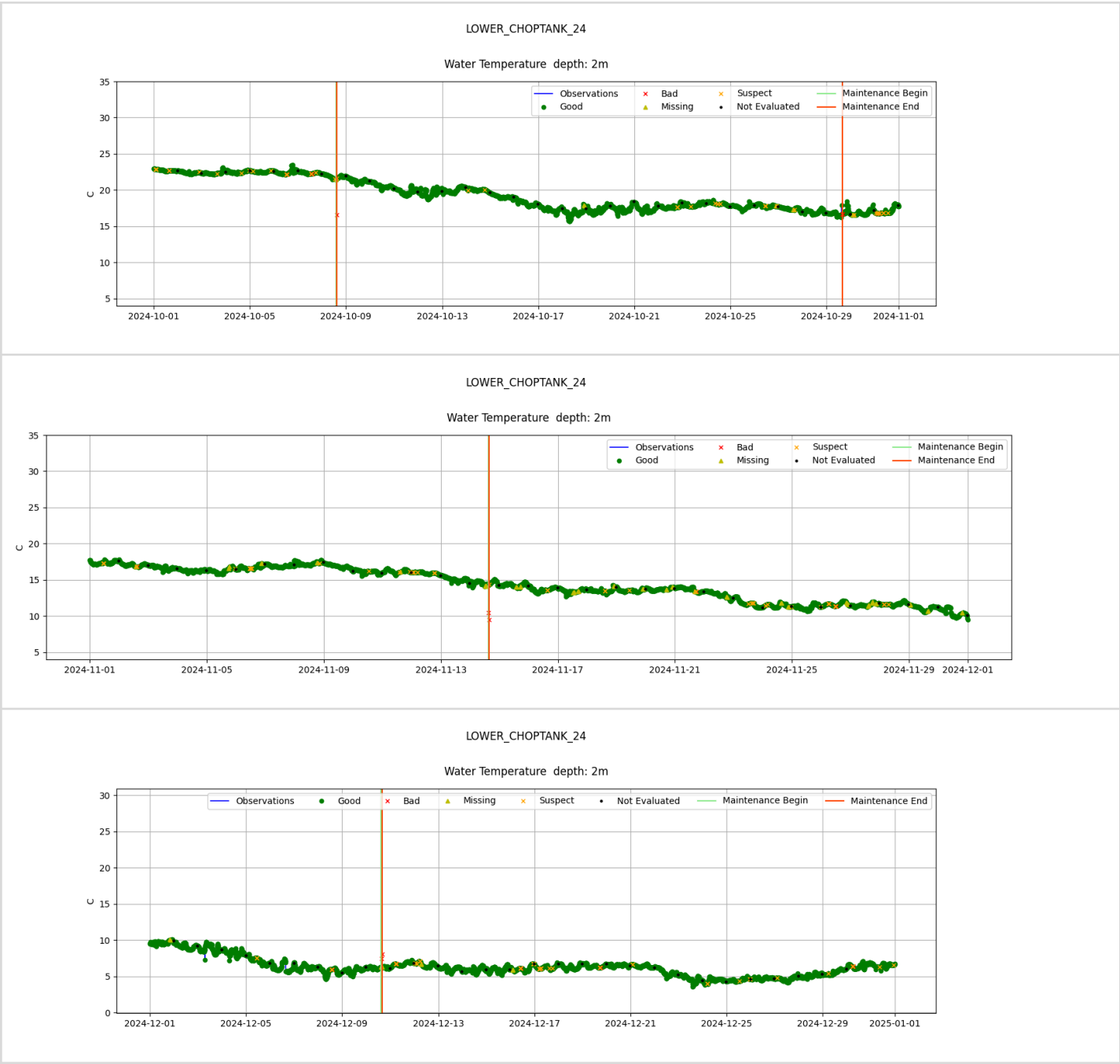




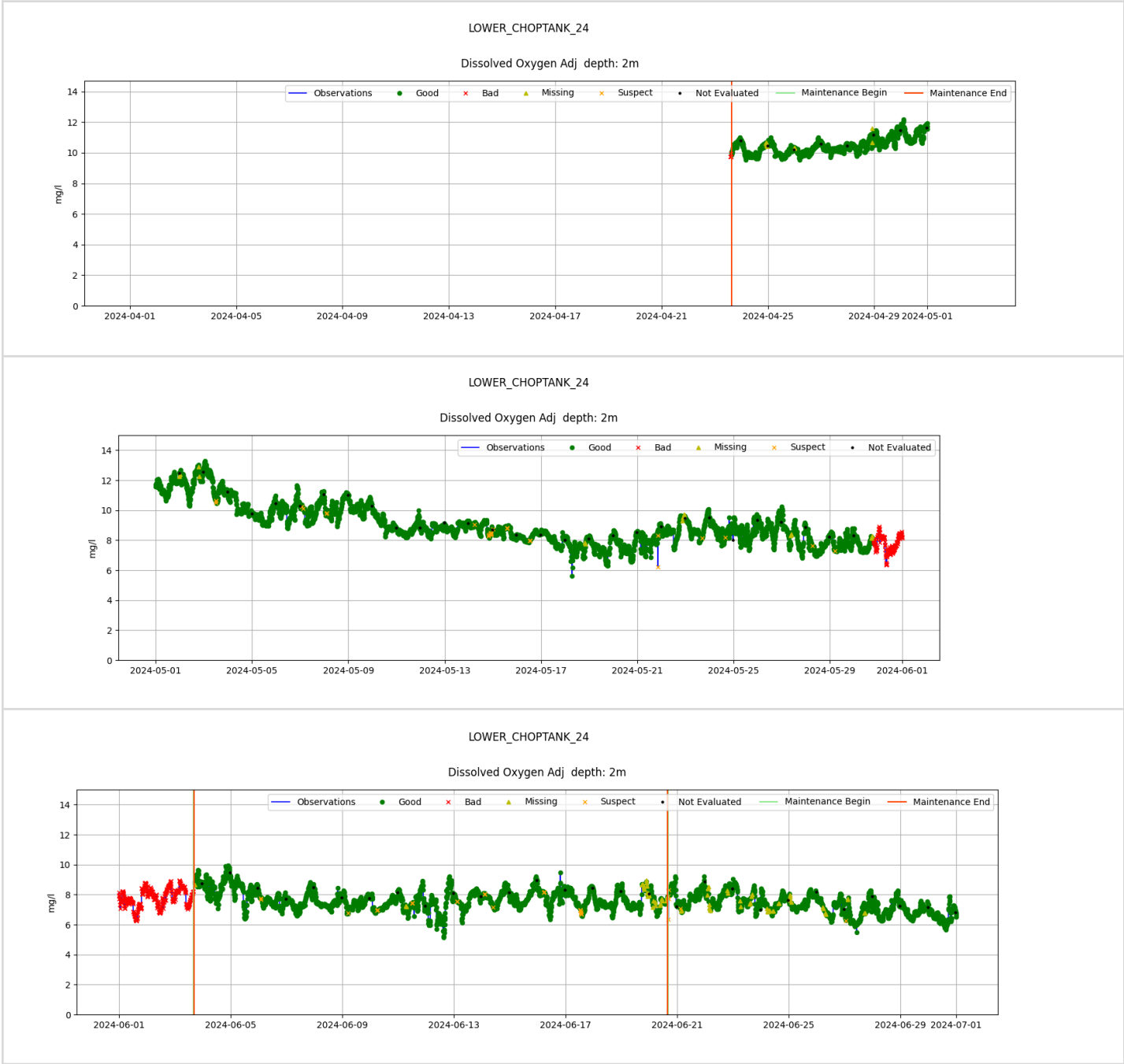
Lower Choptank 2m Water Temperature

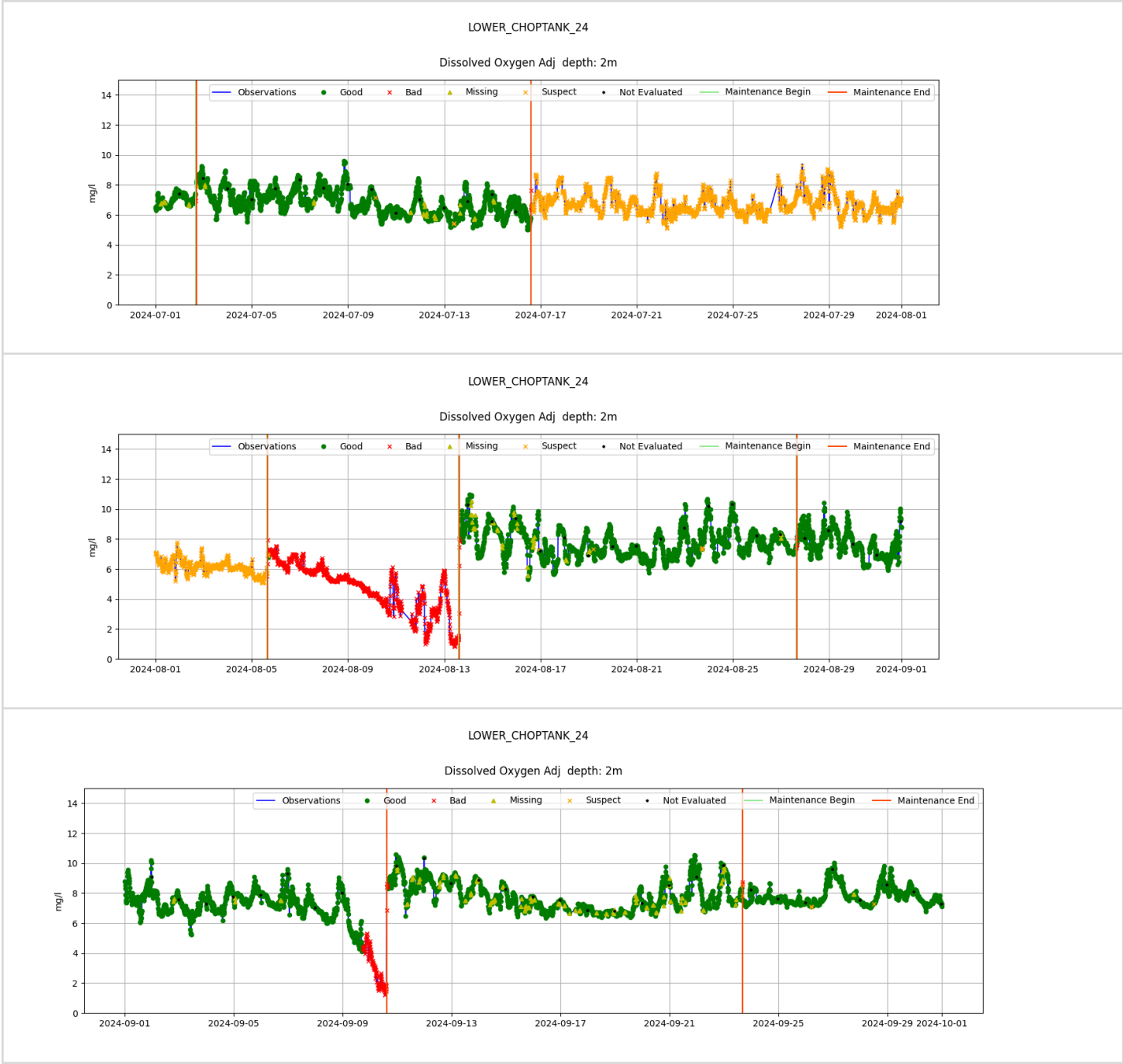




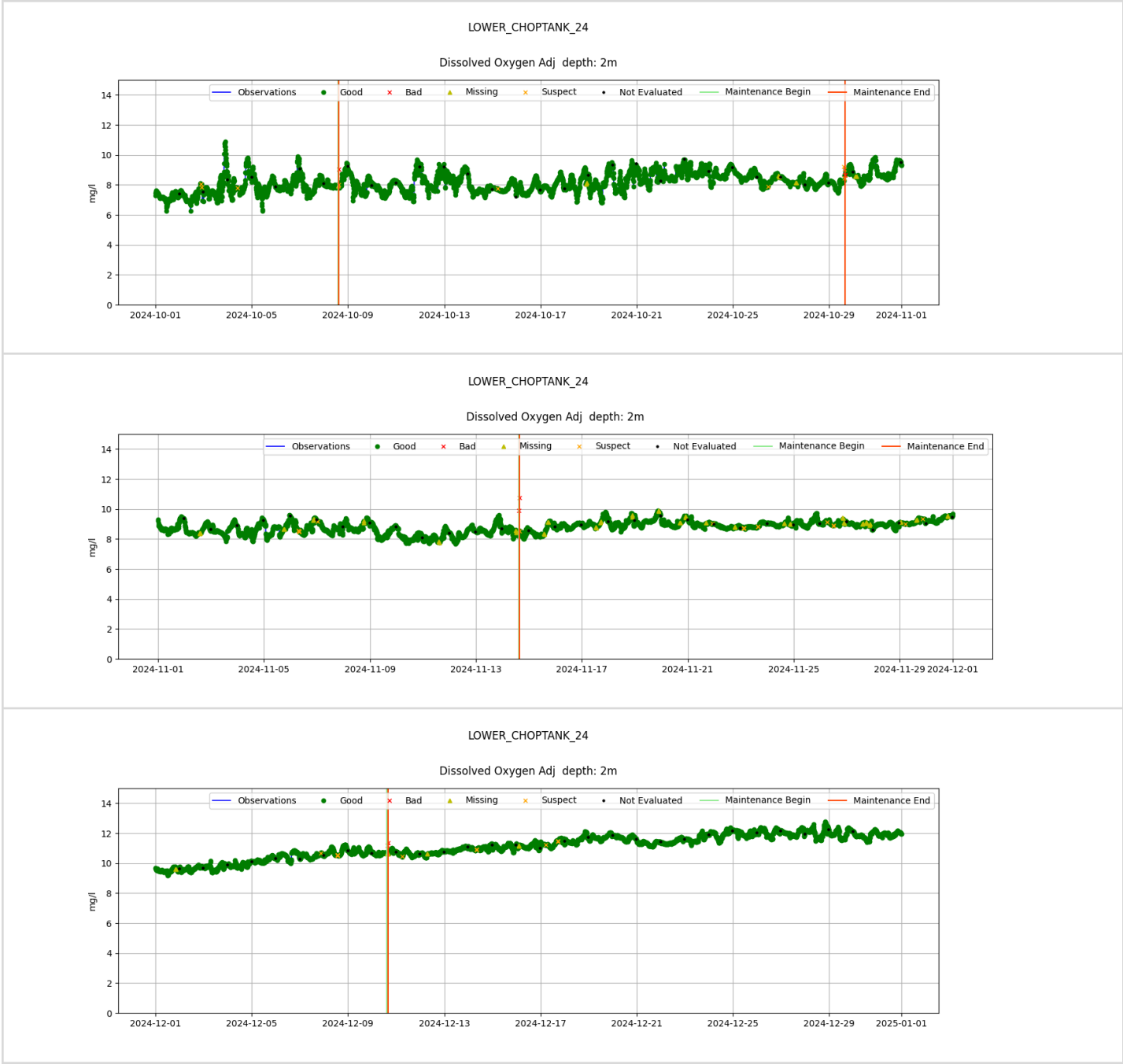


Lower Choptank 2m Dissolved Oxygen Adjusted

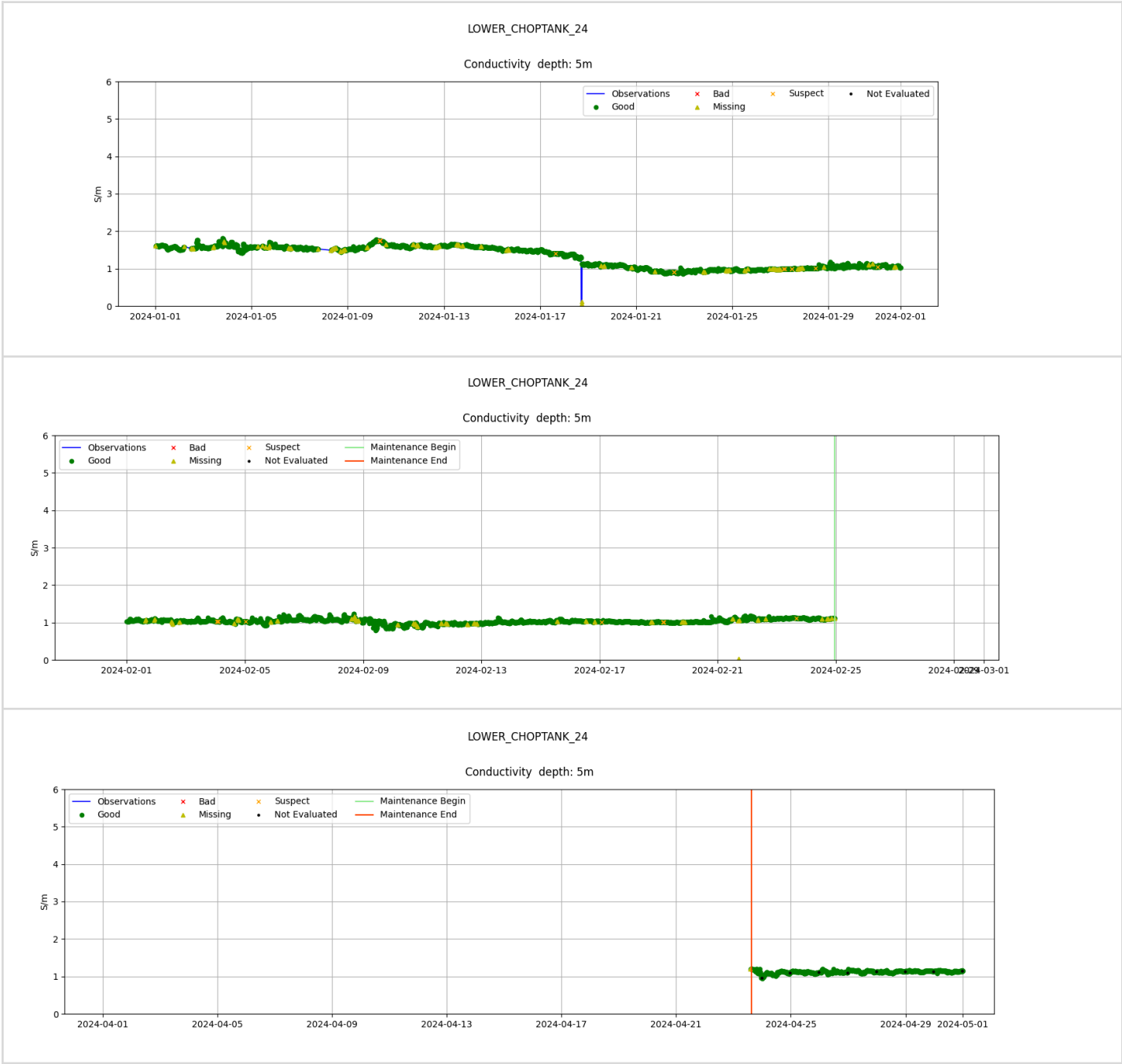


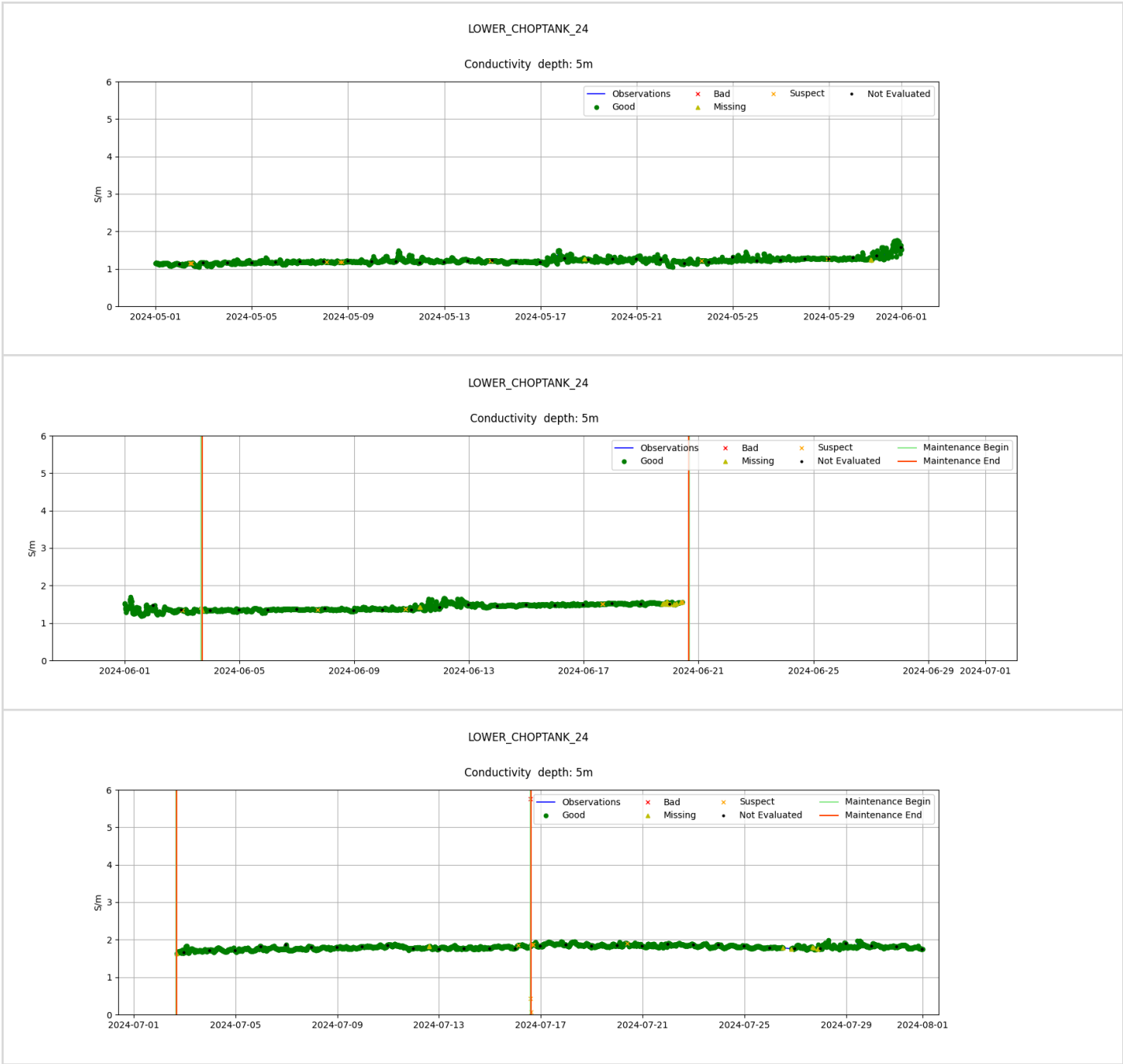


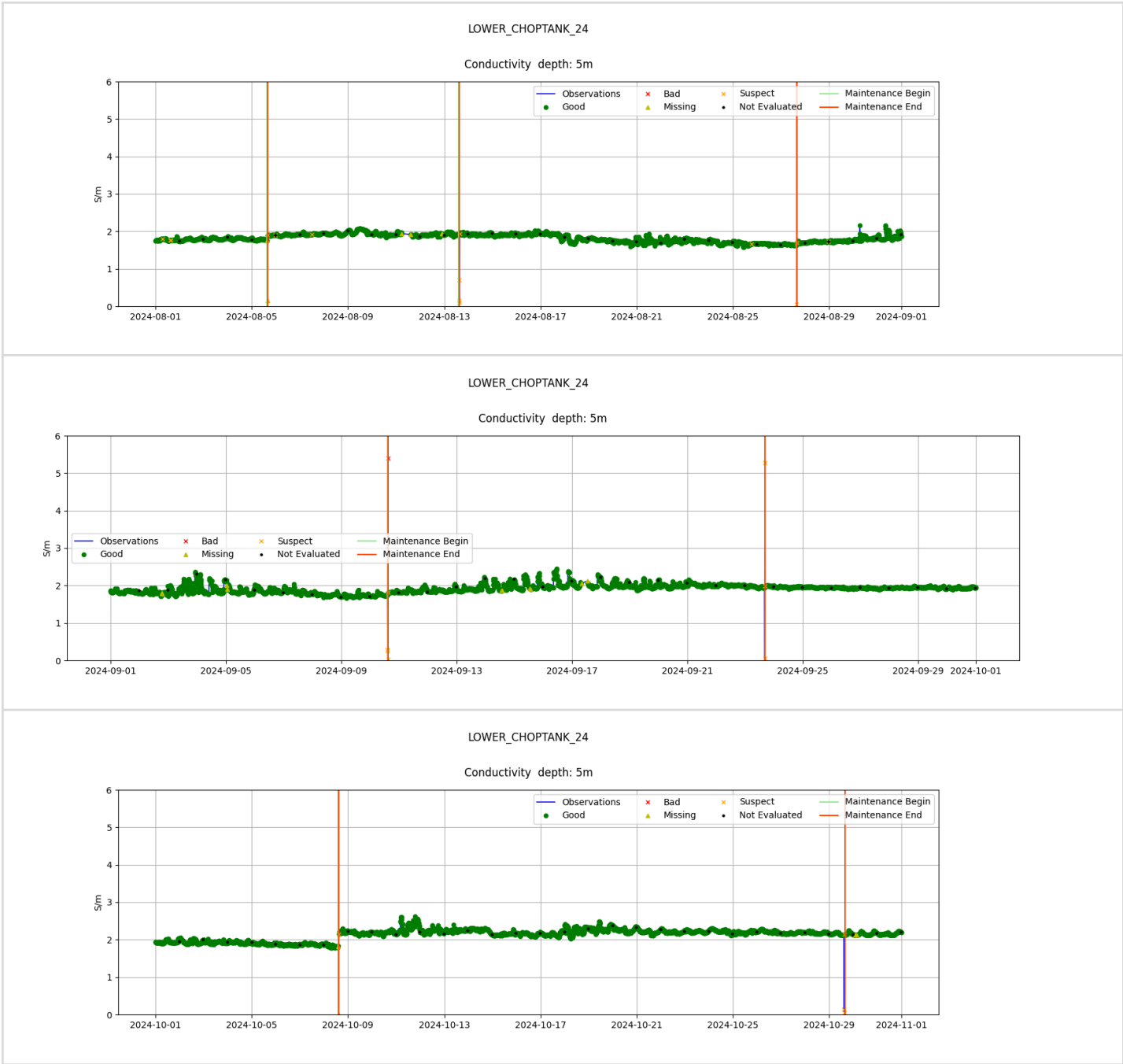




Lower Choptank 5m Conductivity

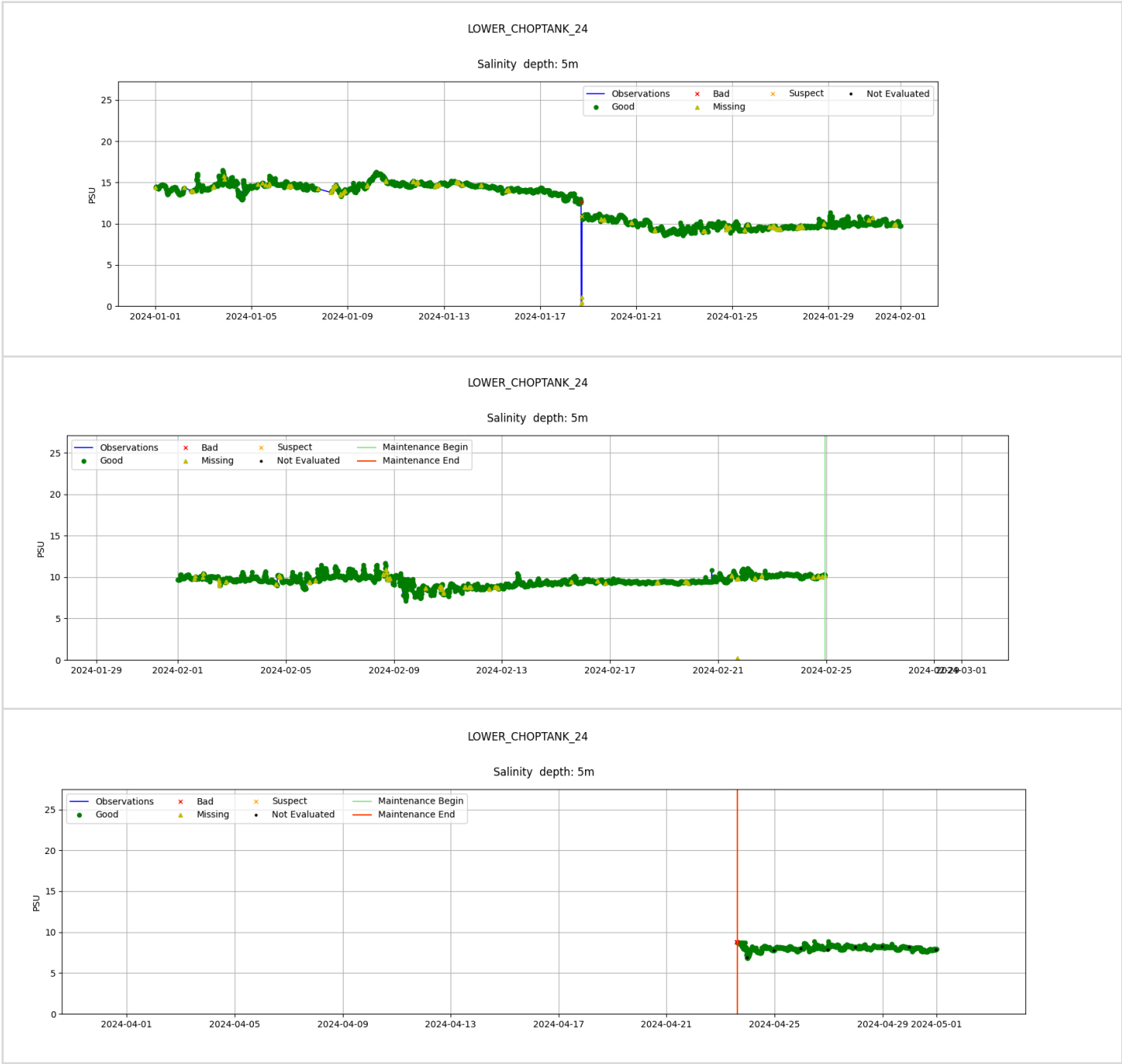


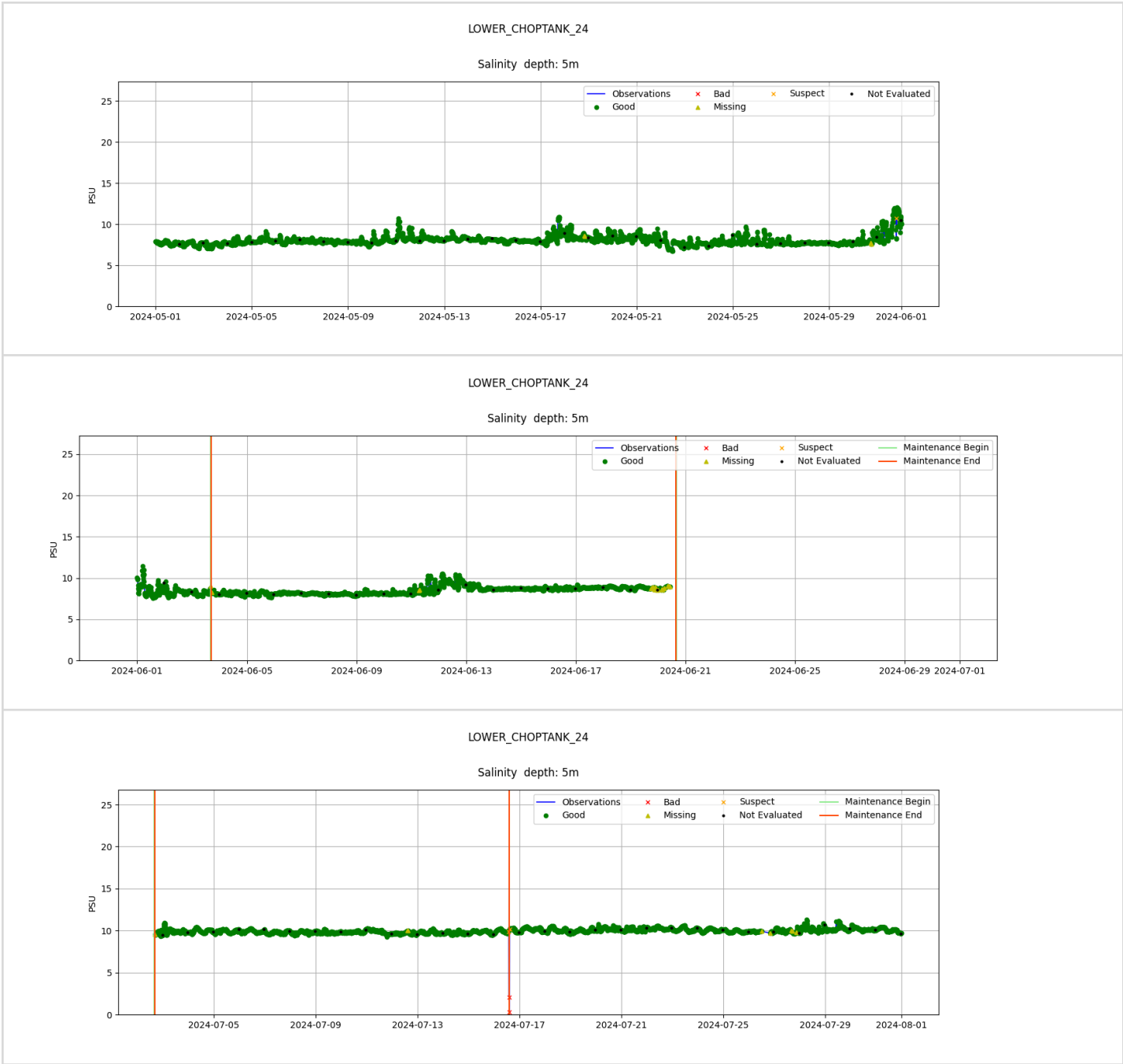


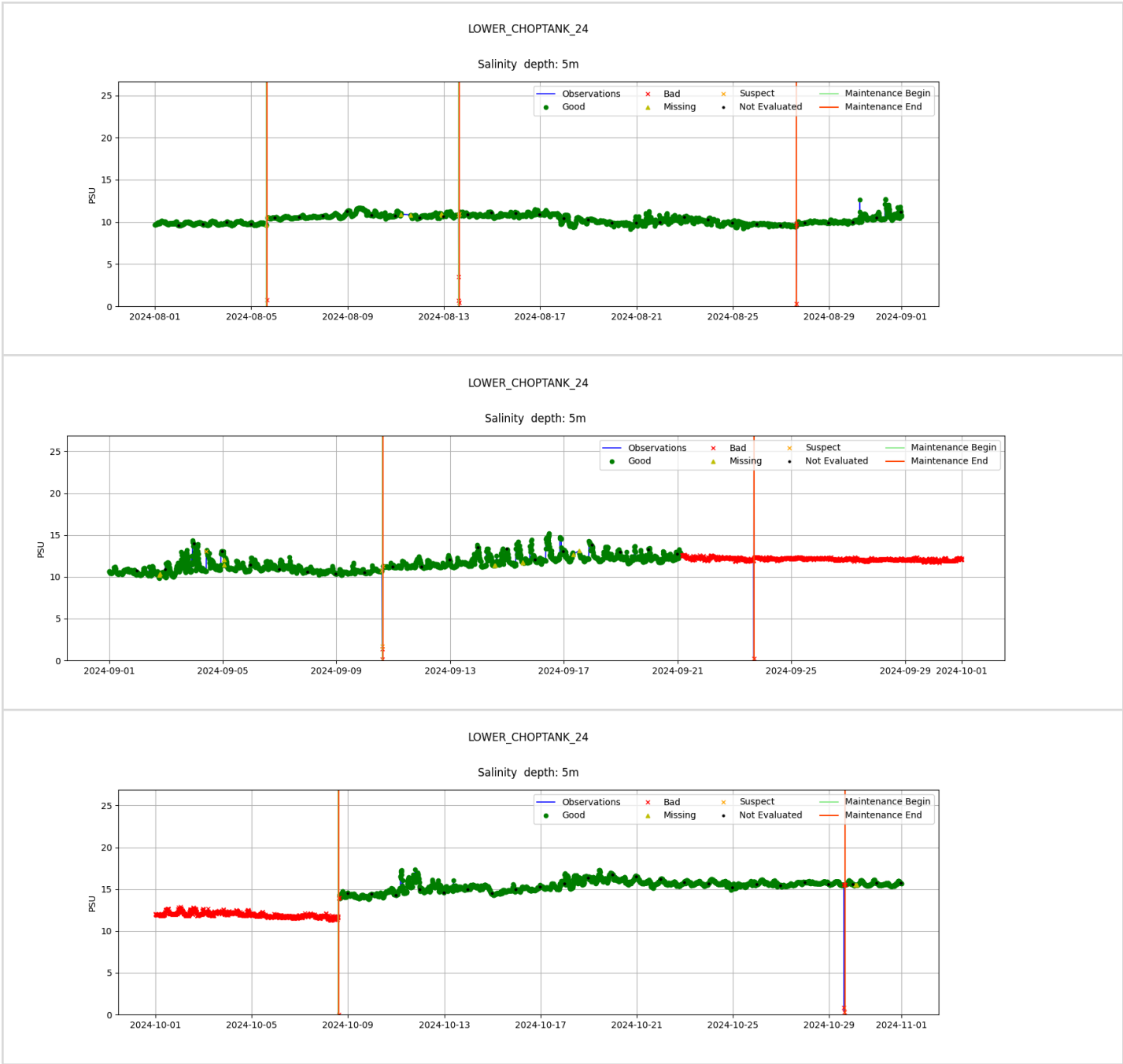




Lower Choptank 5m Salinity





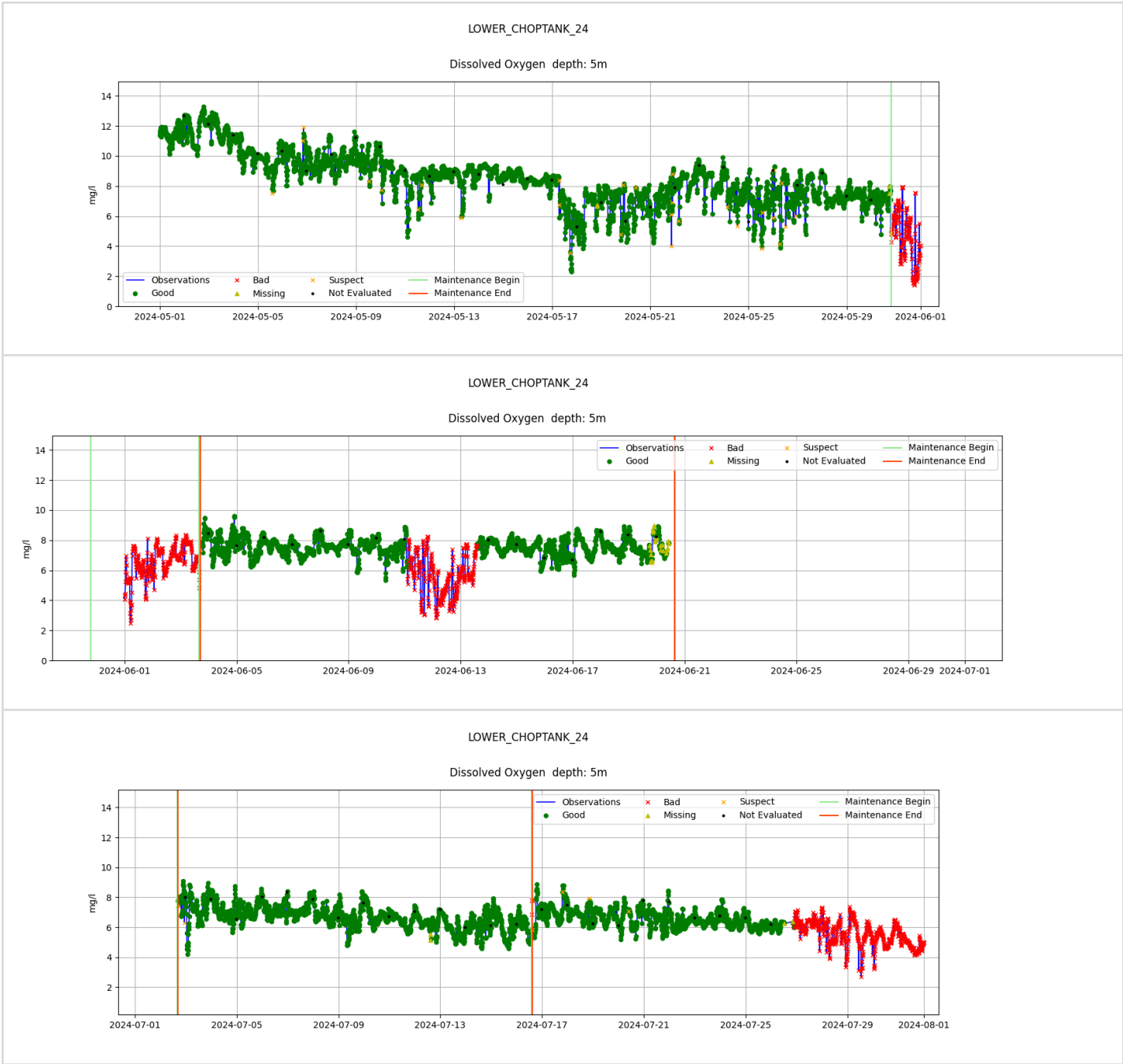


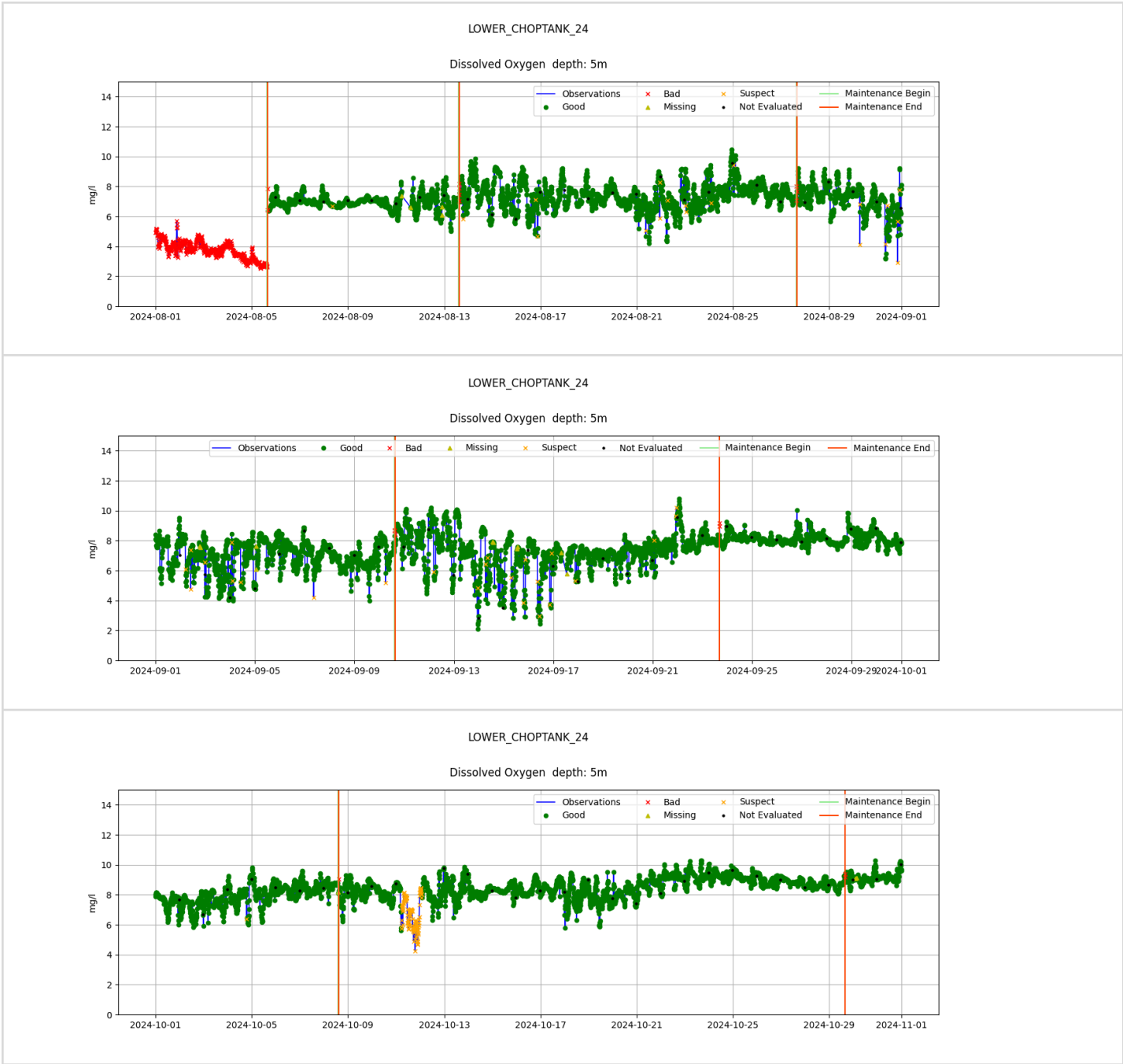




Lower Choptank 5m Dissolved Oxygen

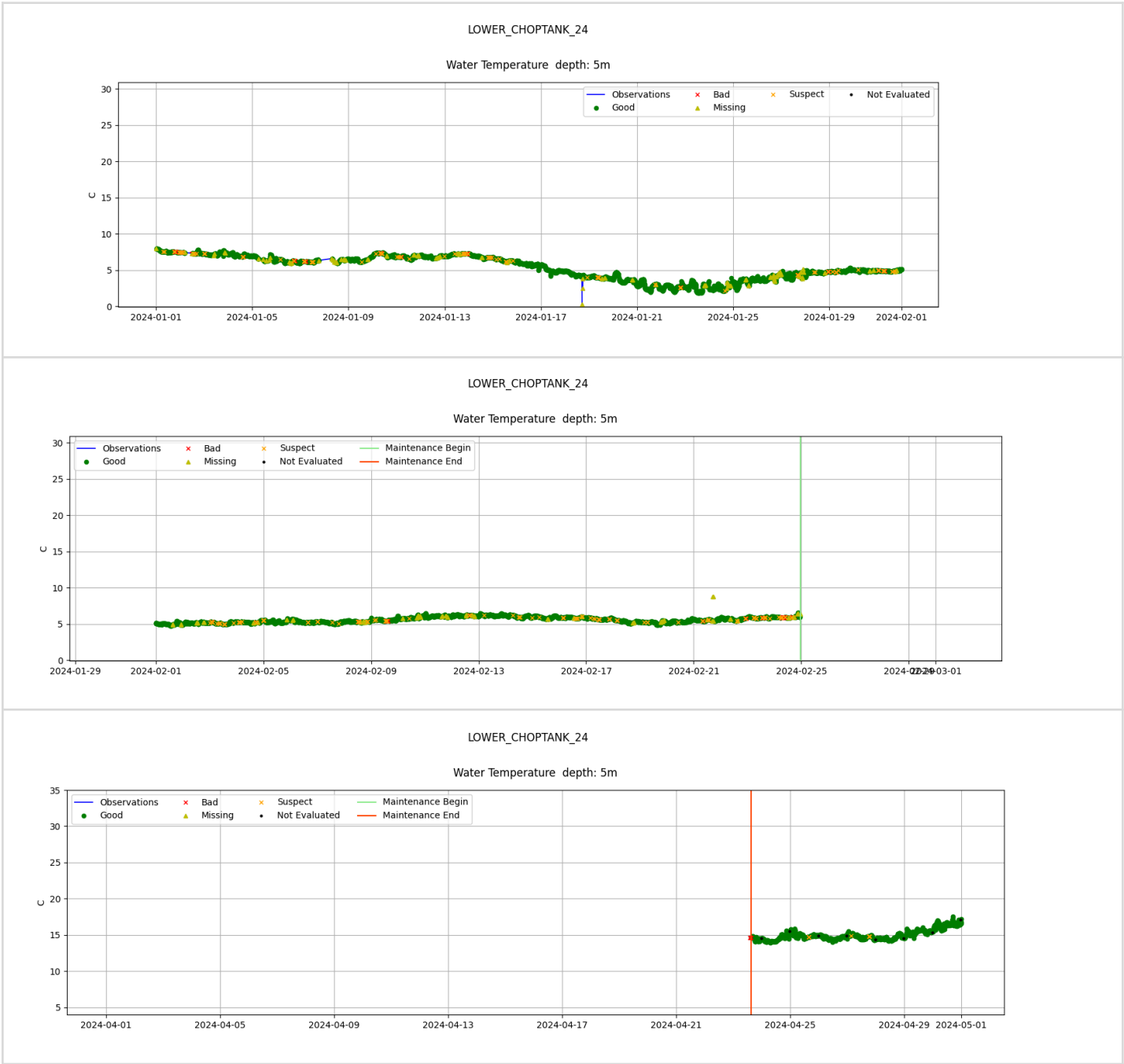




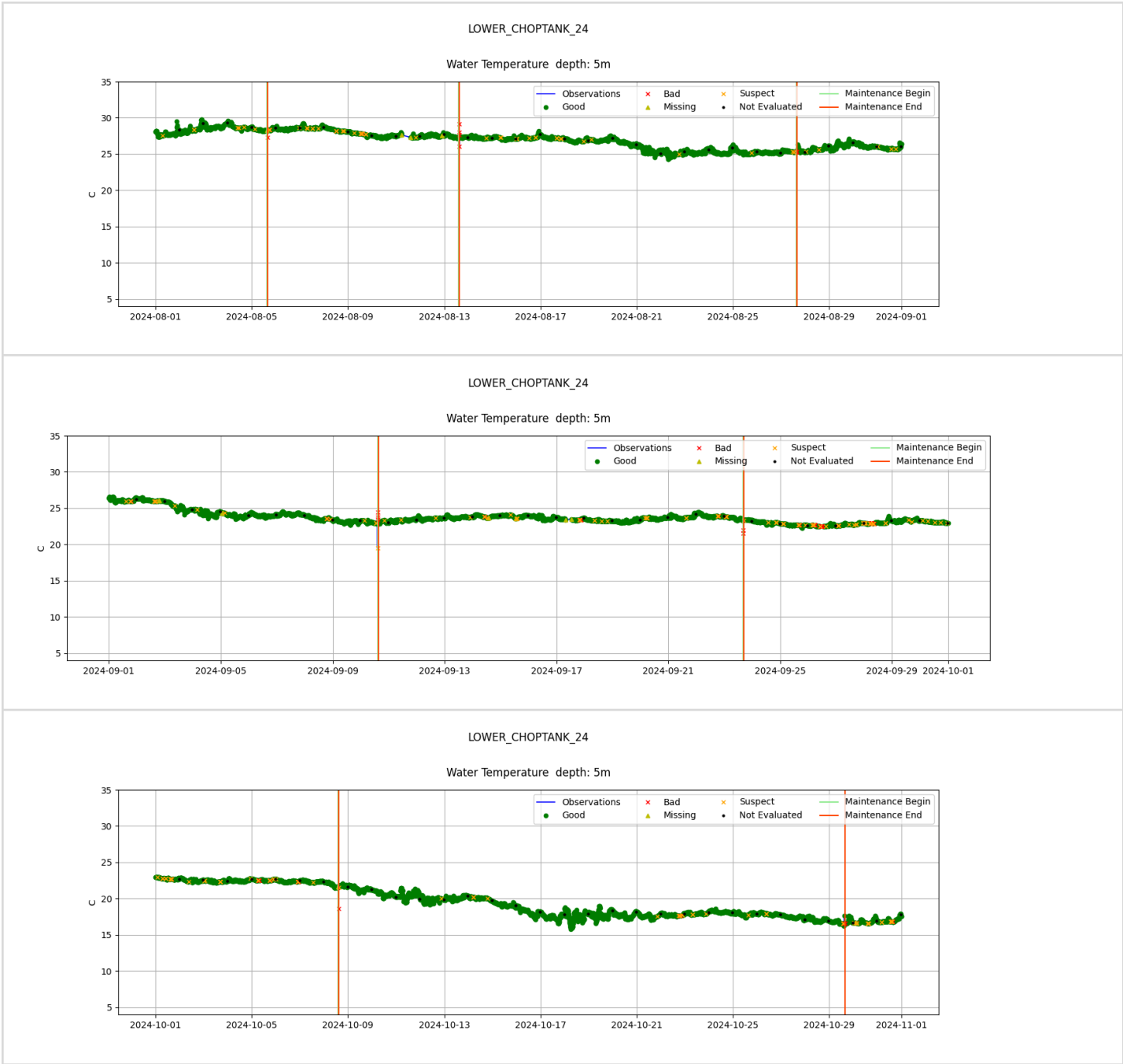




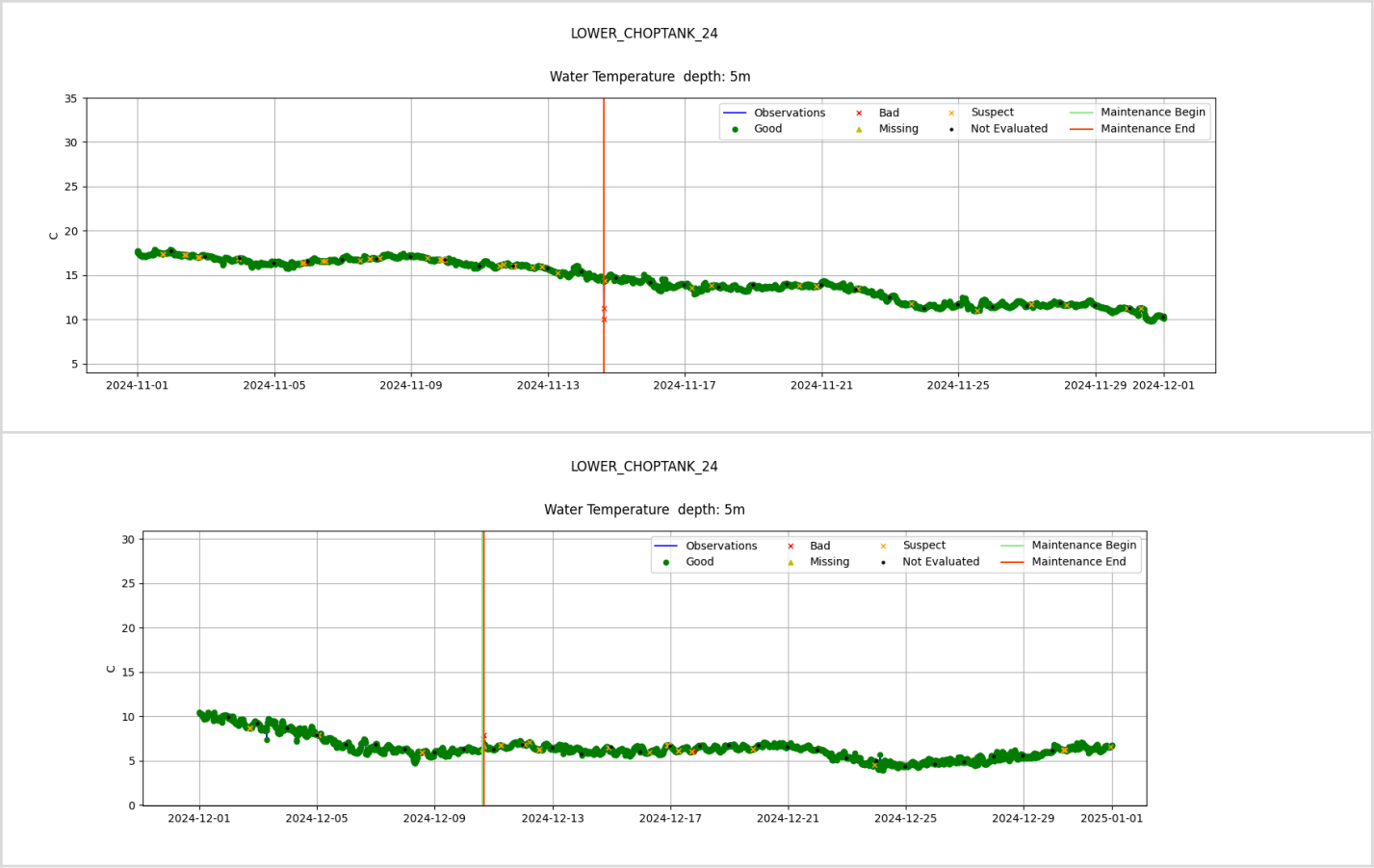
Lower Choptank 5m Water Temperature



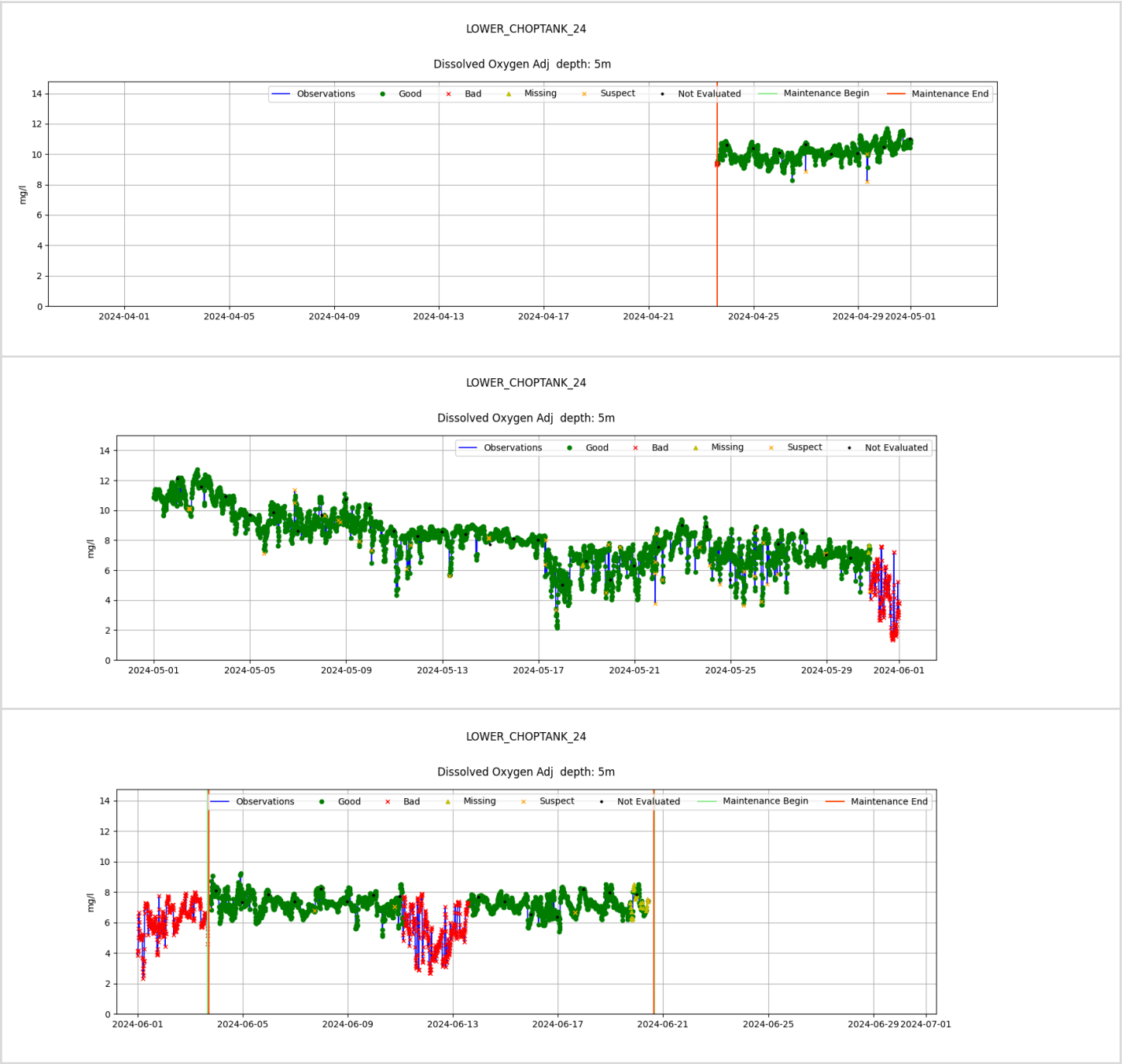


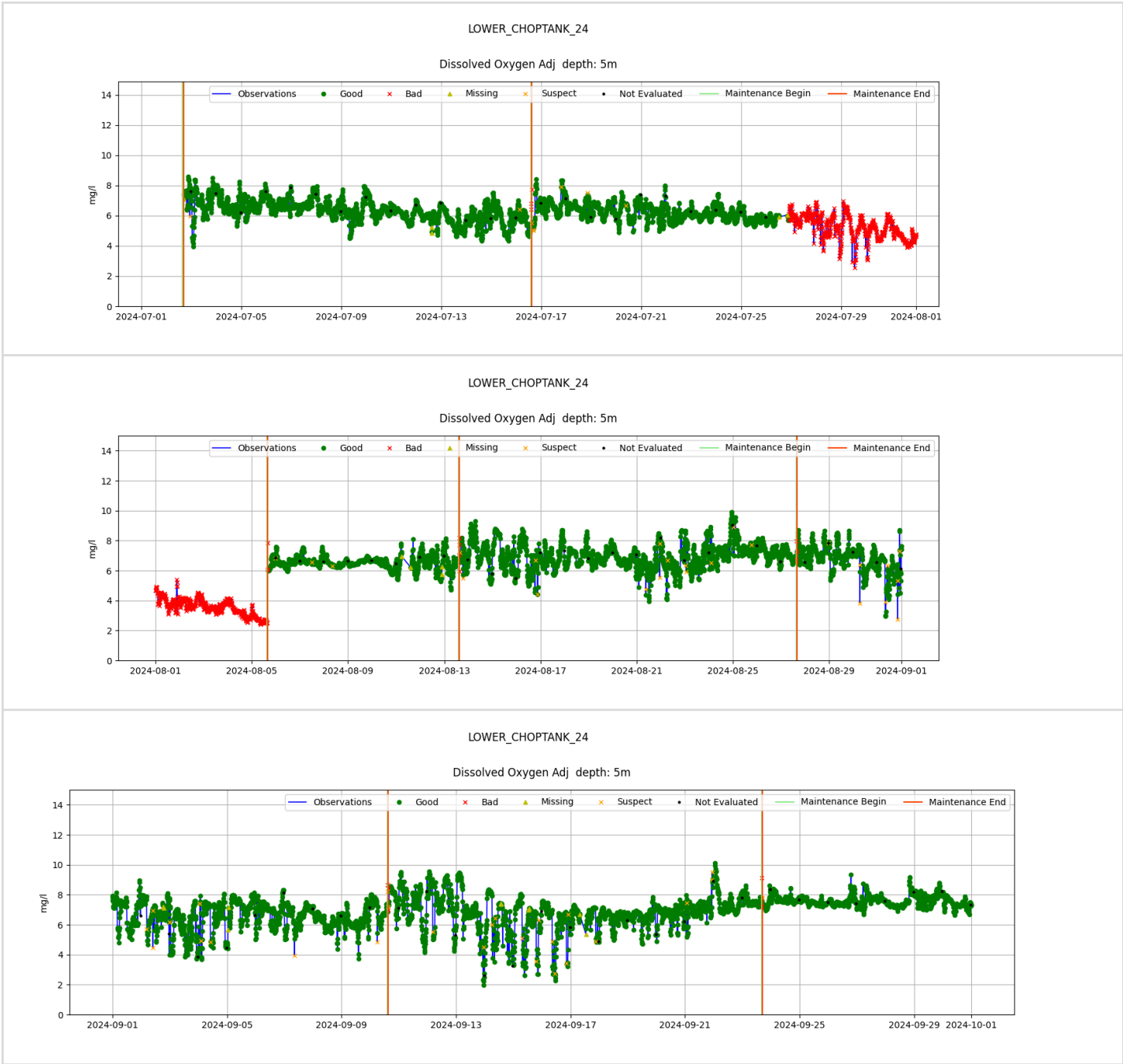


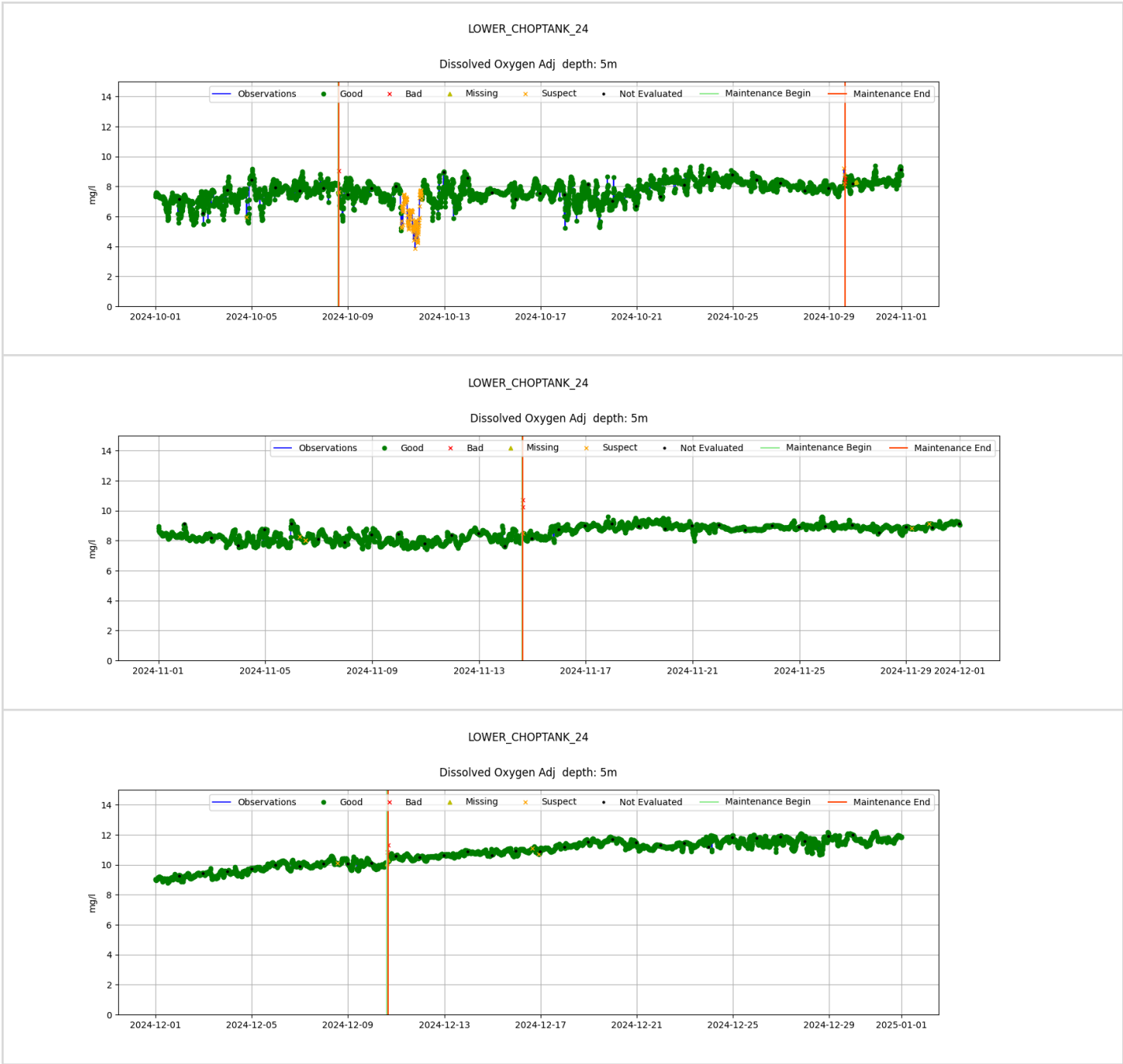




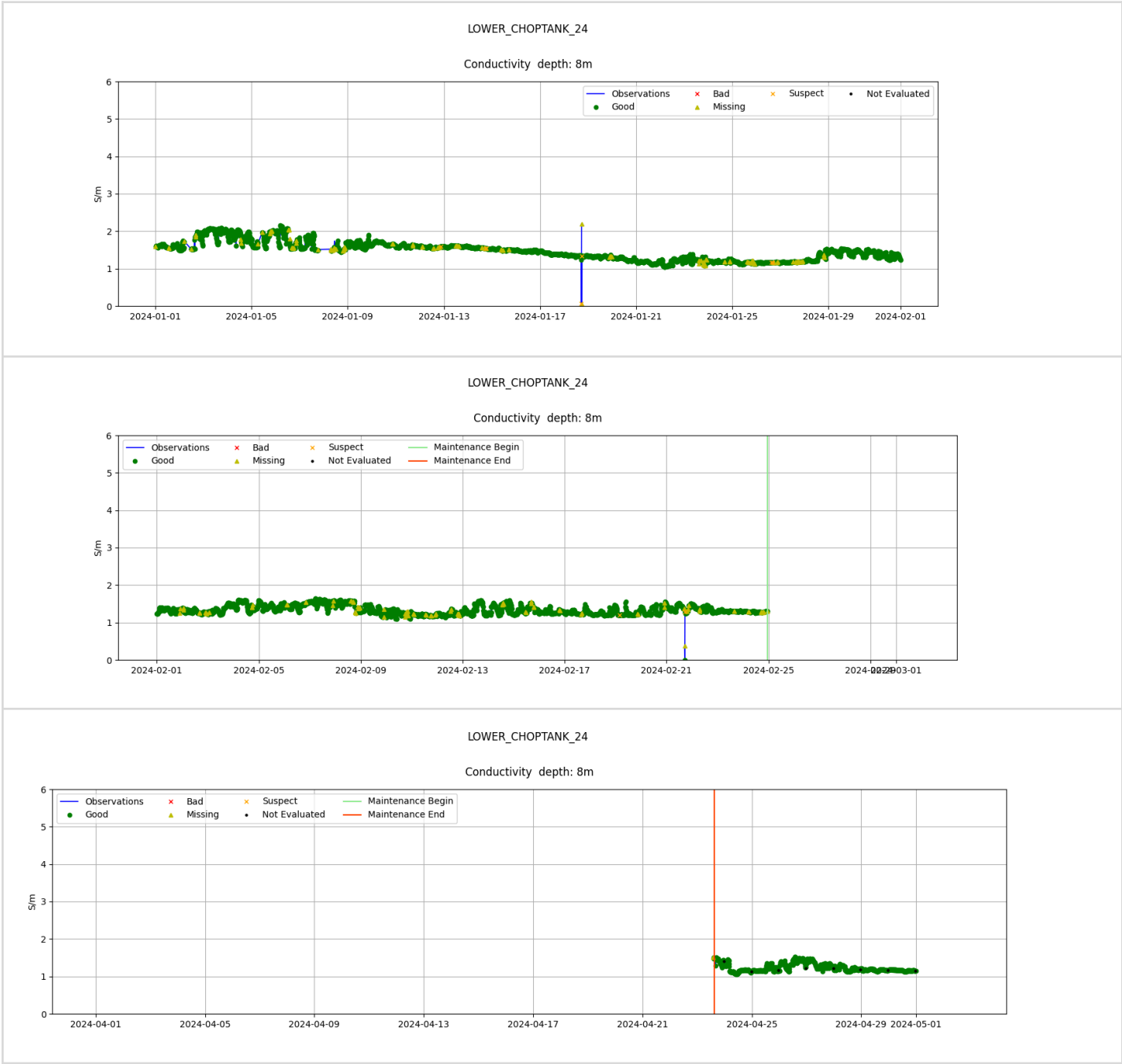
Lower Choptank 5m Dissolved Oxygen Adjusted

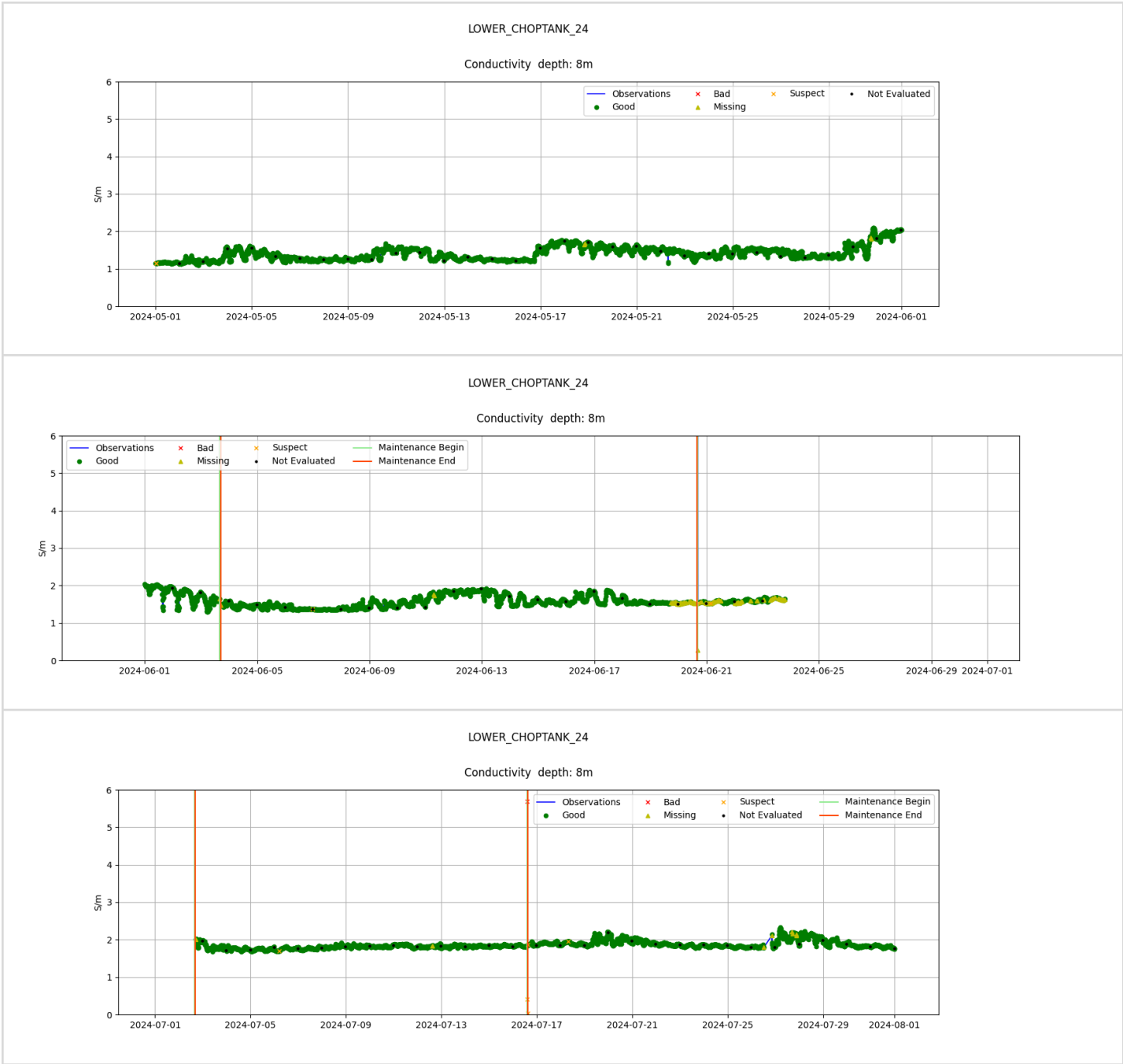


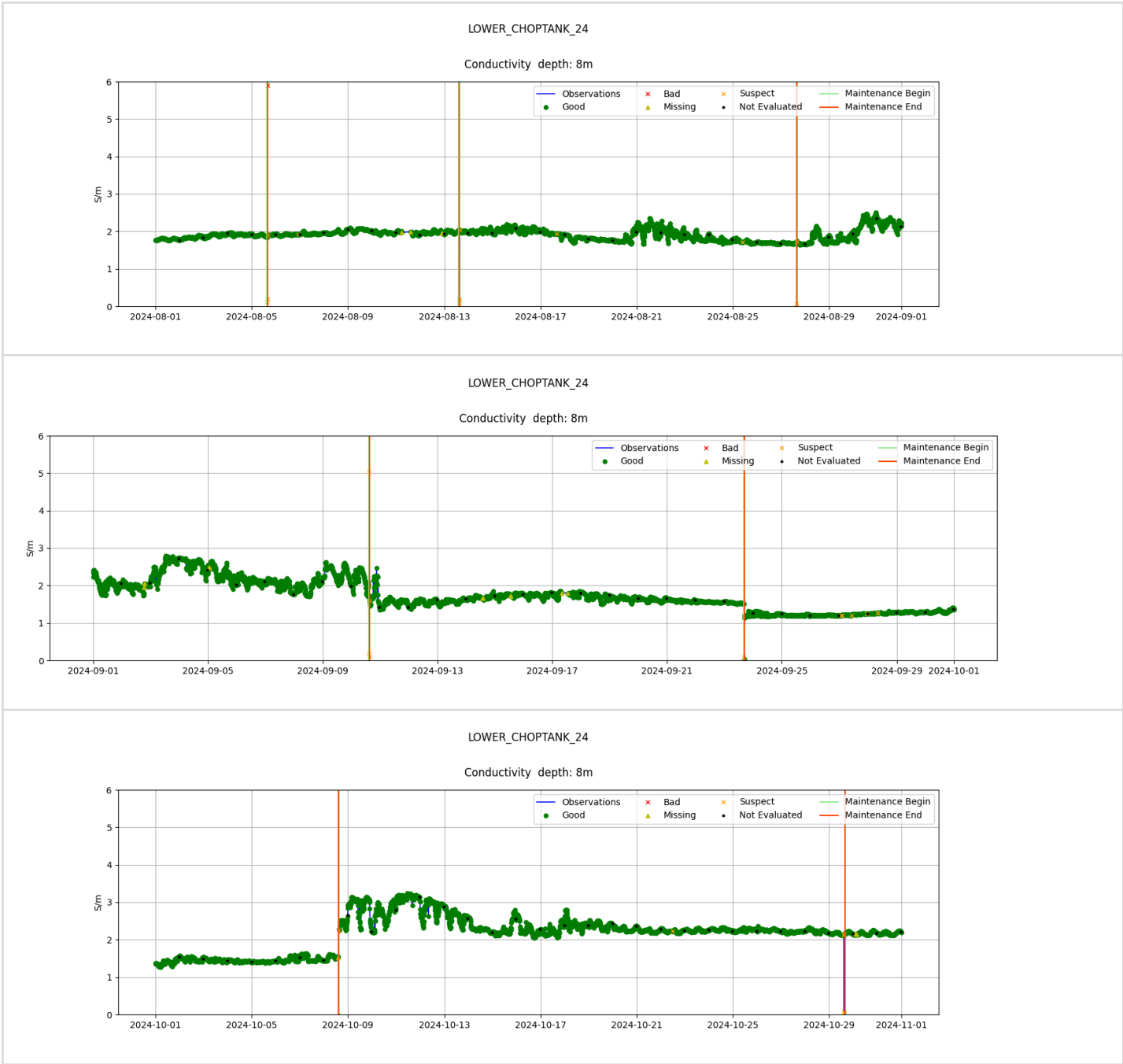




Lower Choptank 8m Conductivity



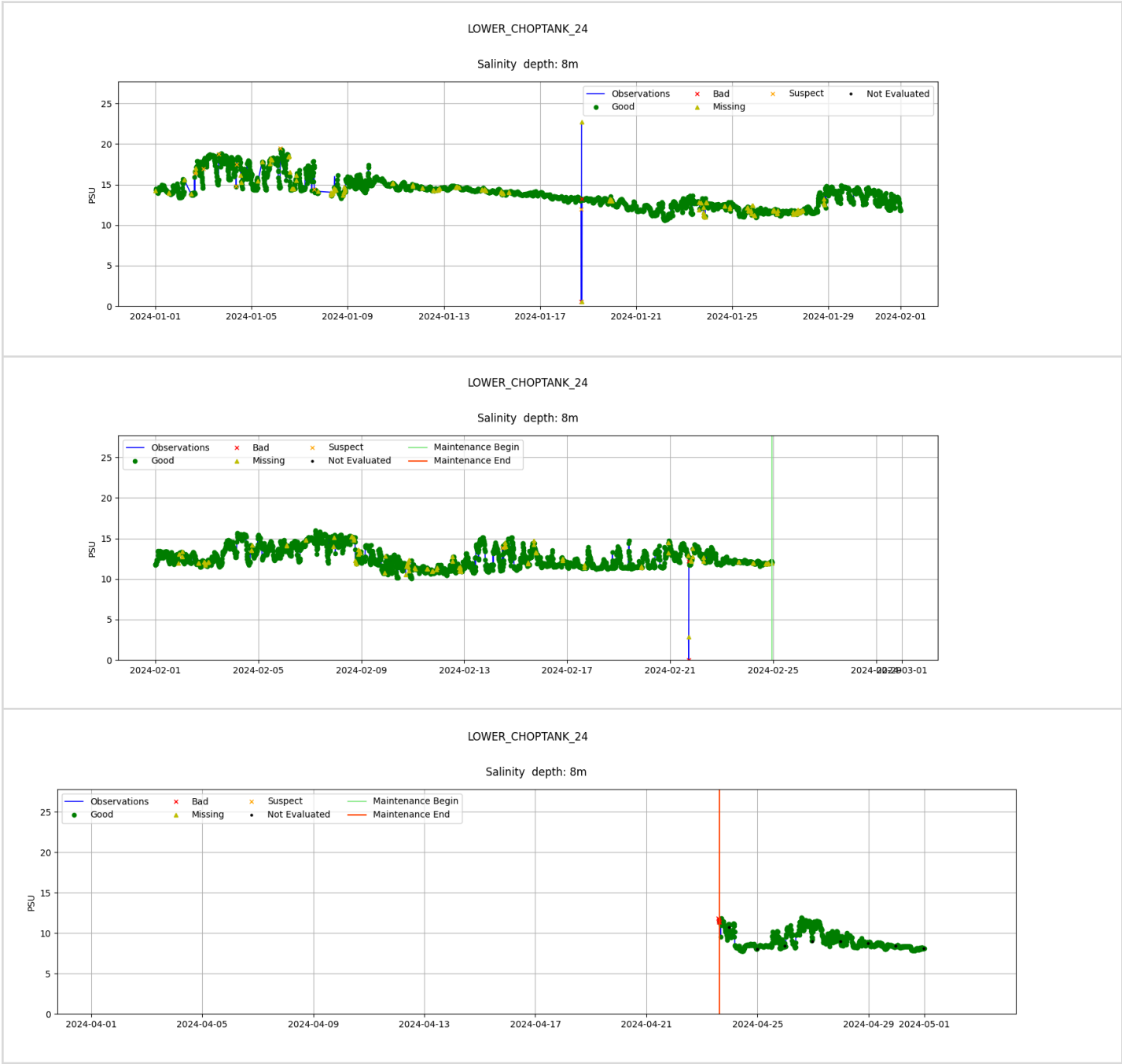


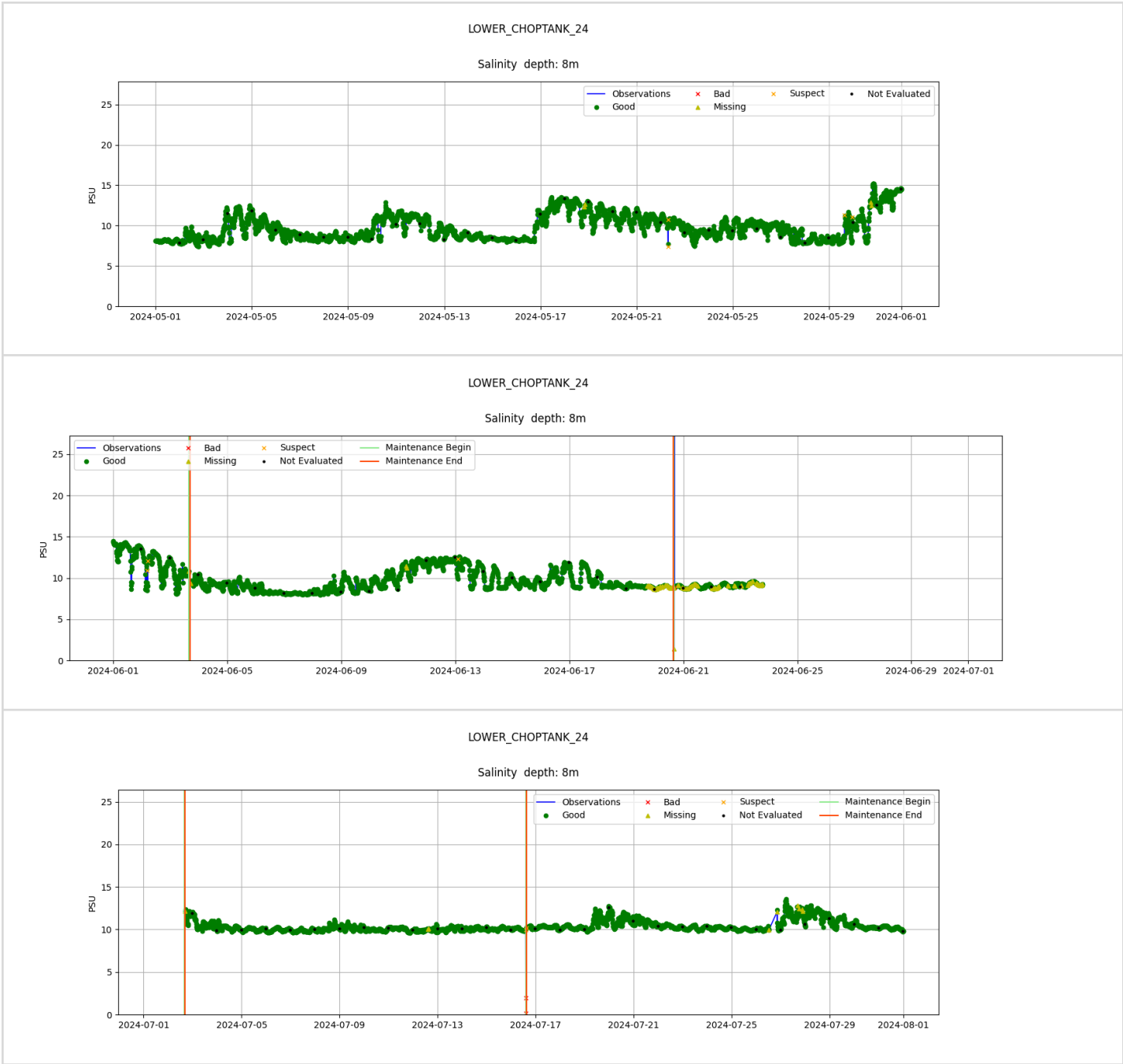


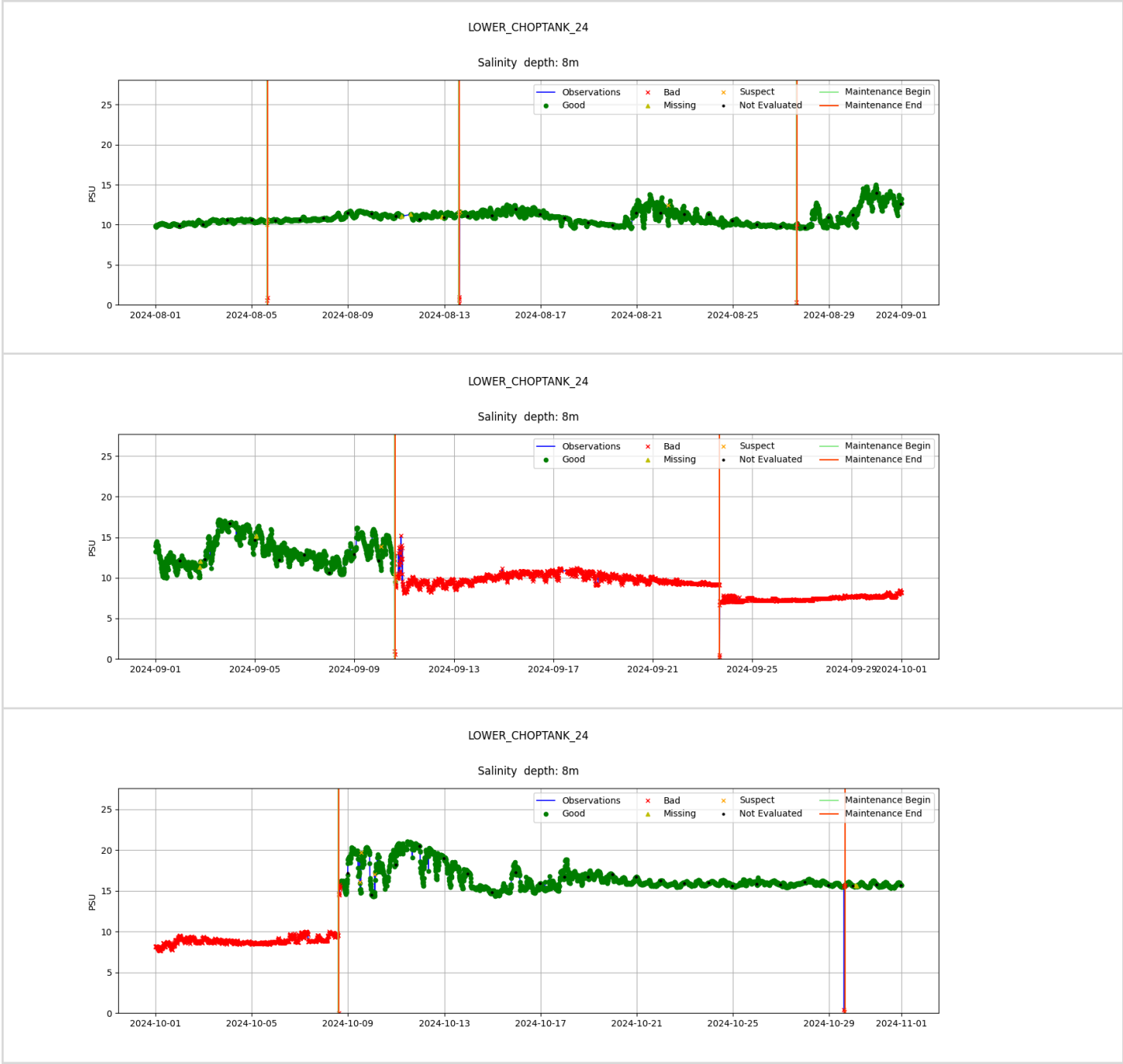




Lower Choptank 8m Salinity

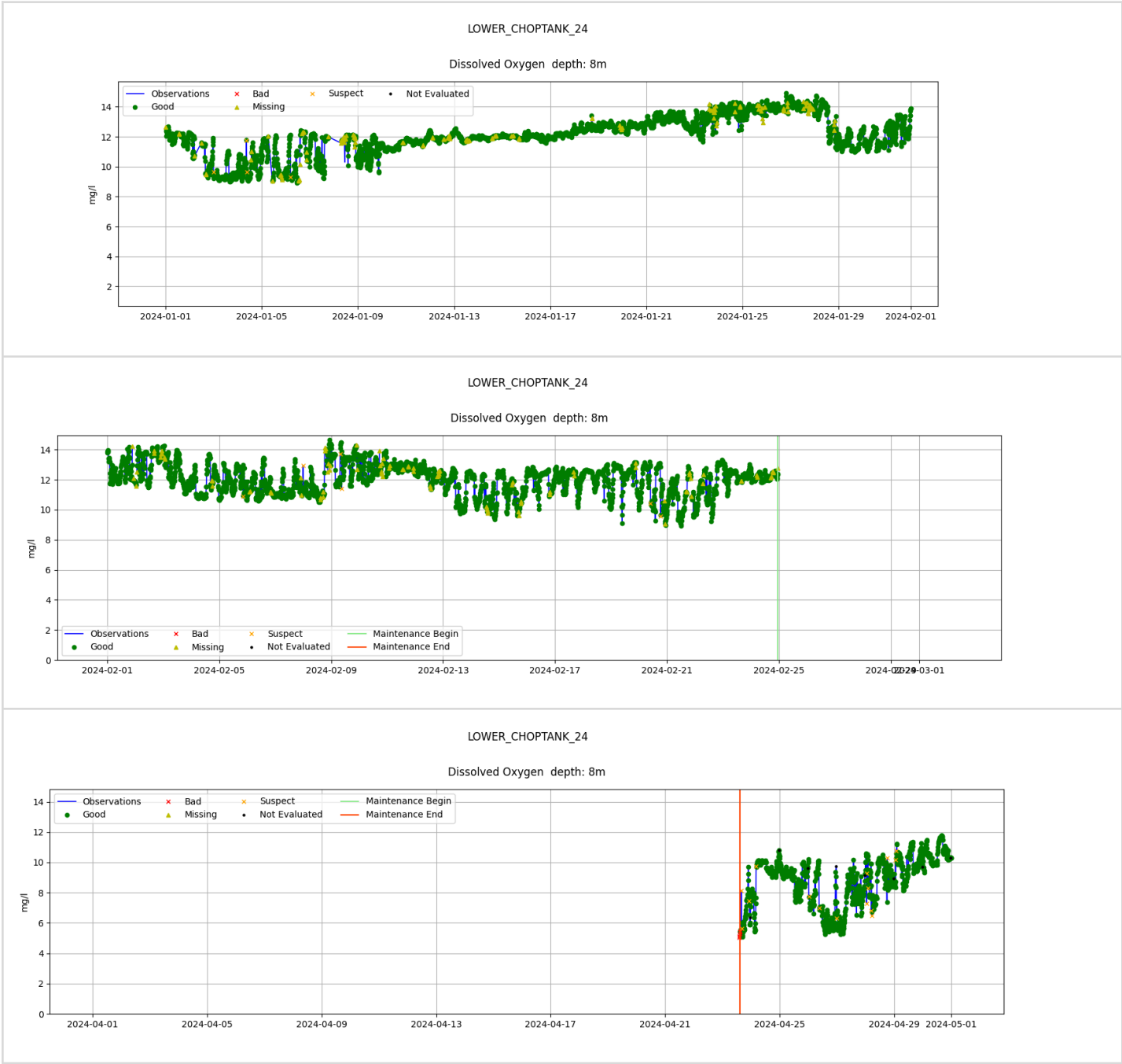


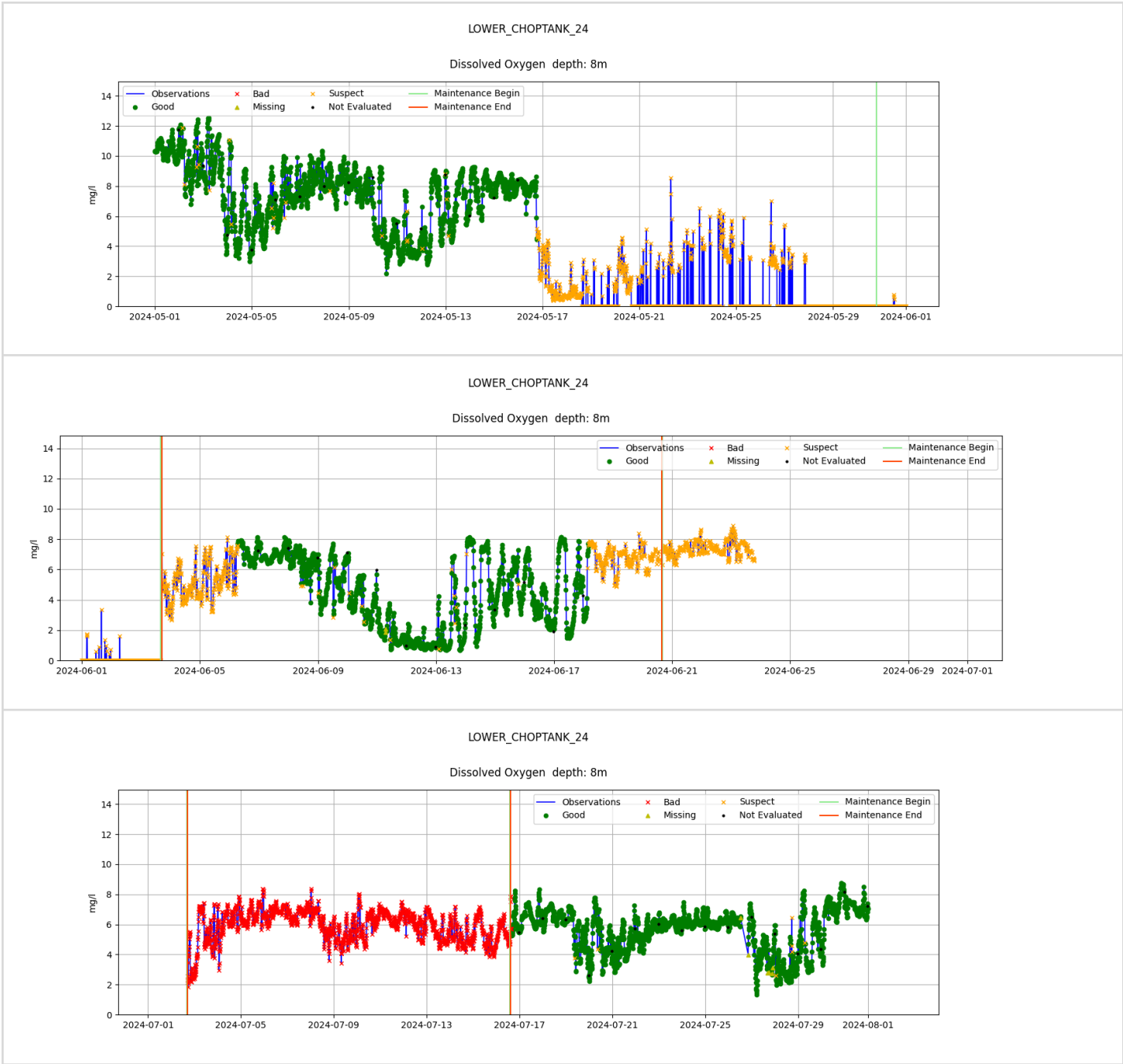


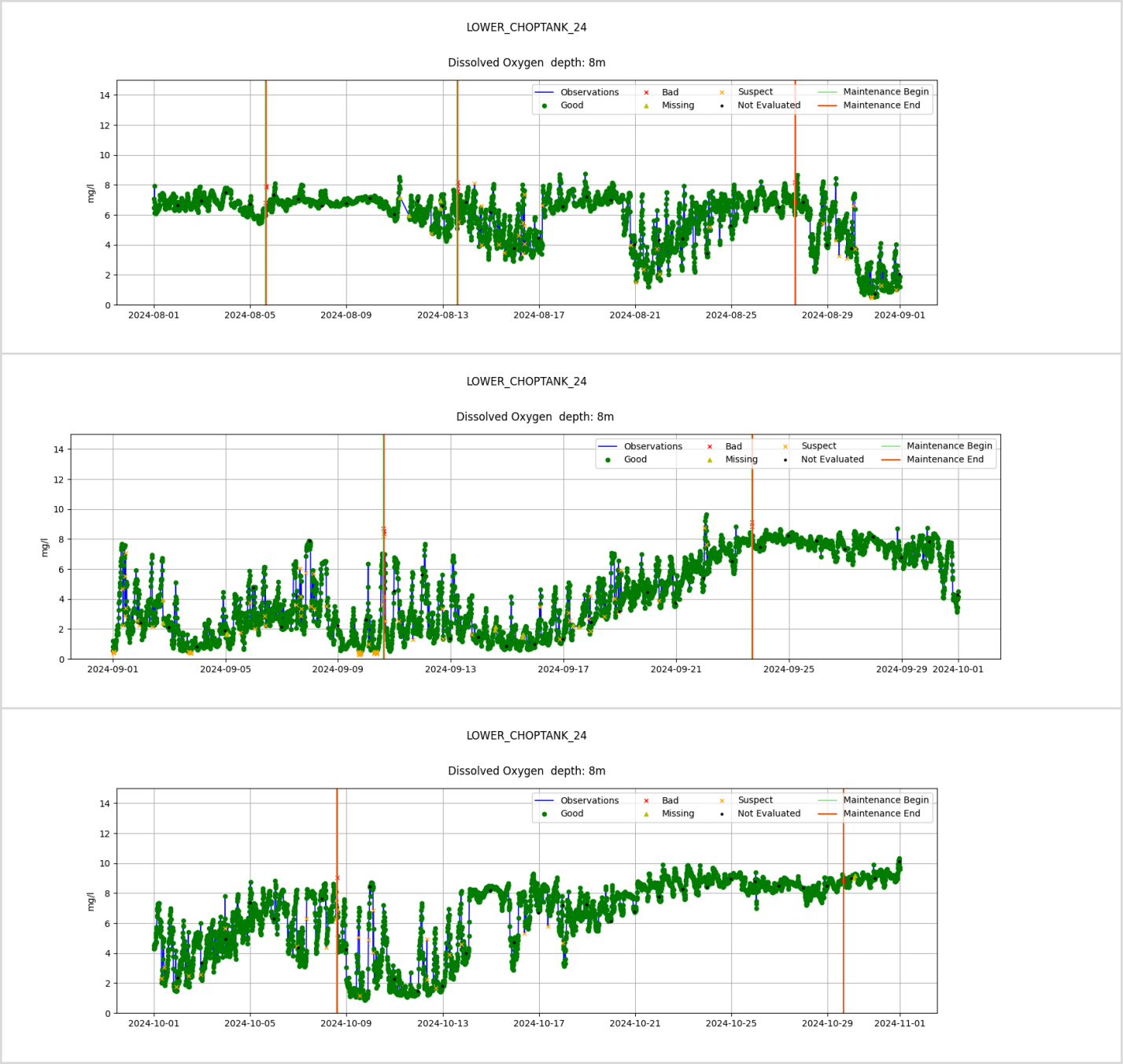




Lower Choptank 8m Dissolved Oxygen

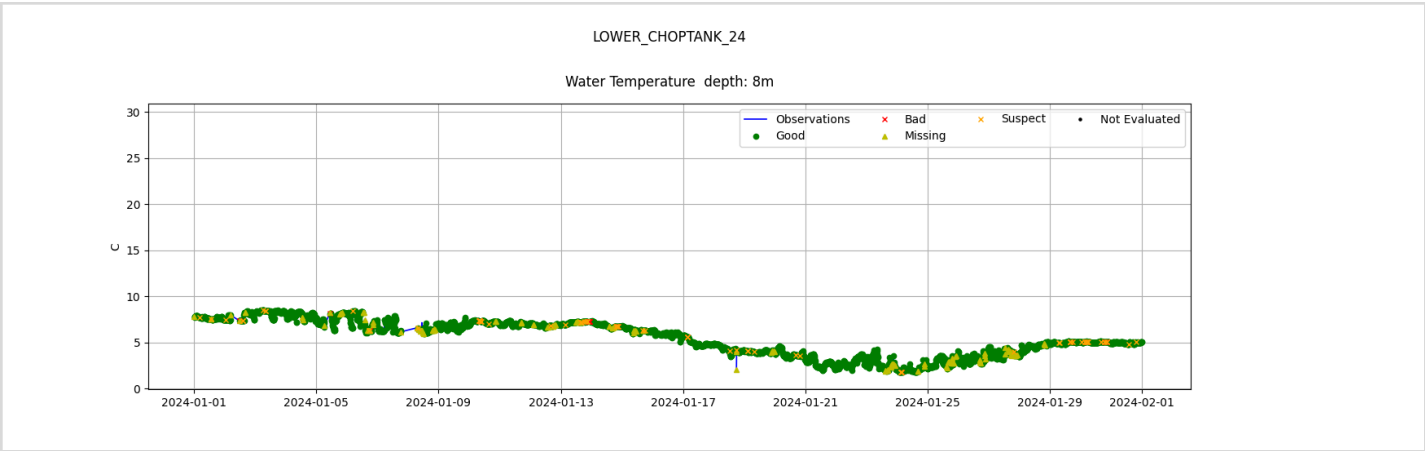




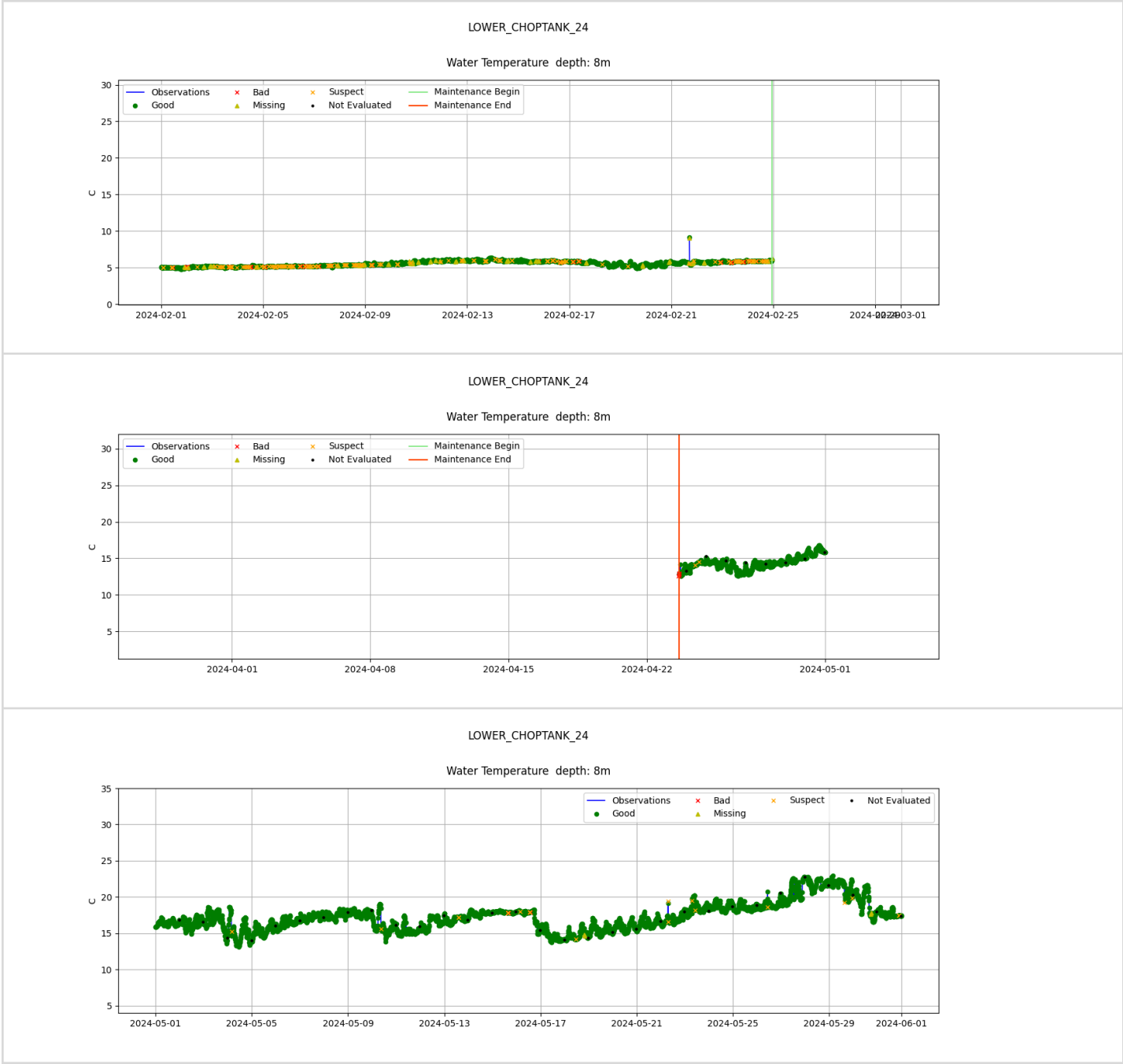


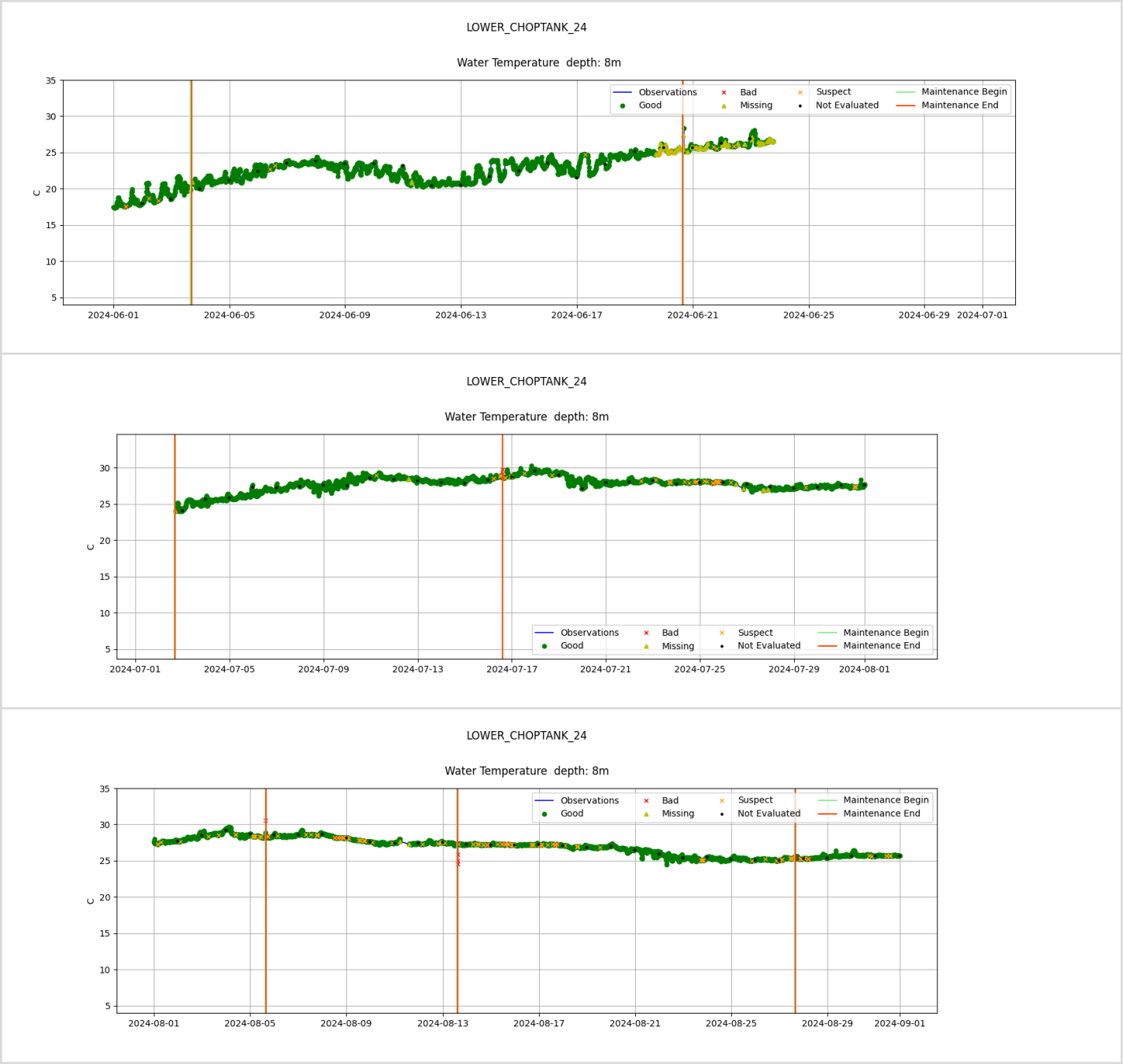


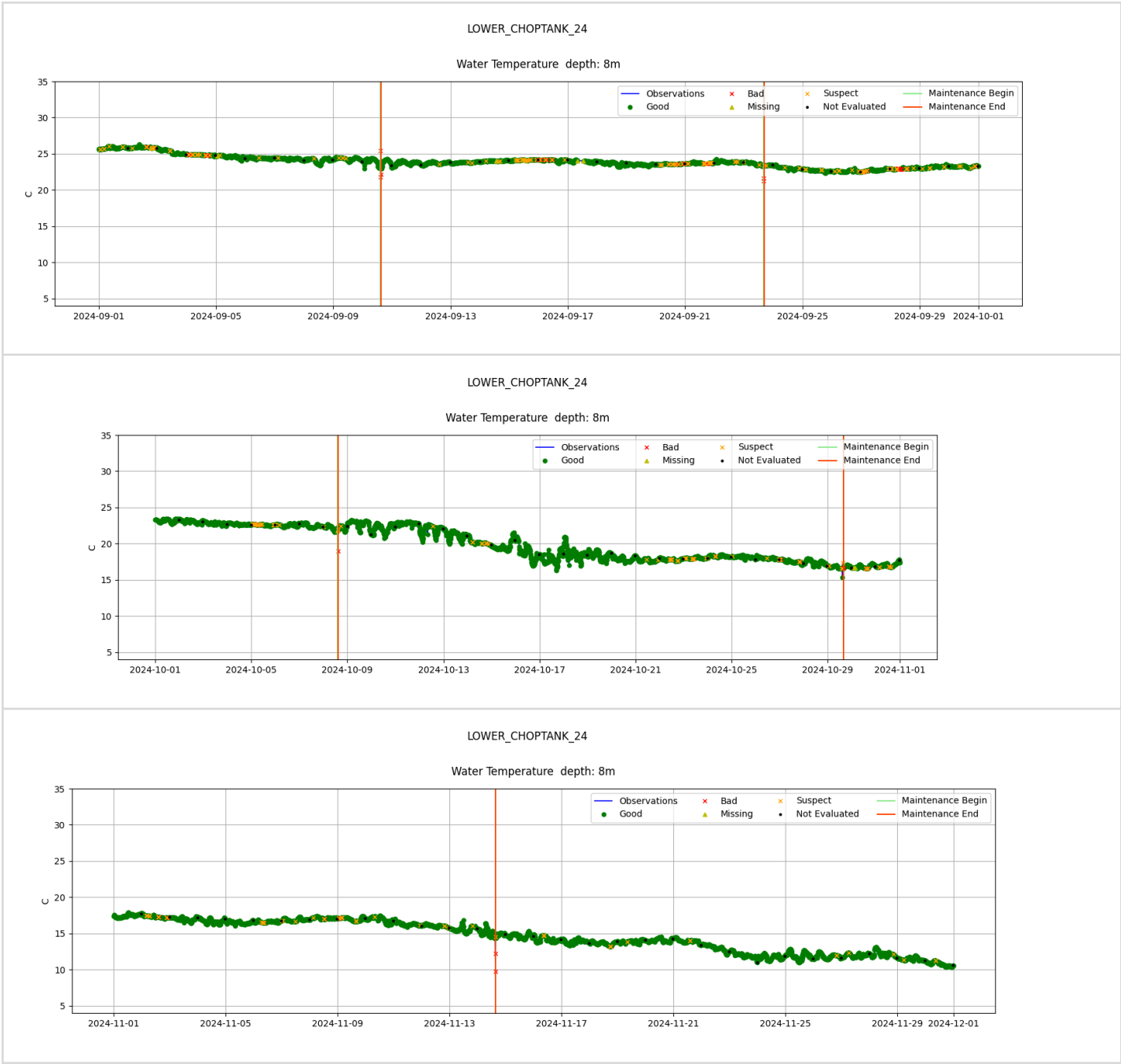
### Lower Choptank 8m Water Temperature

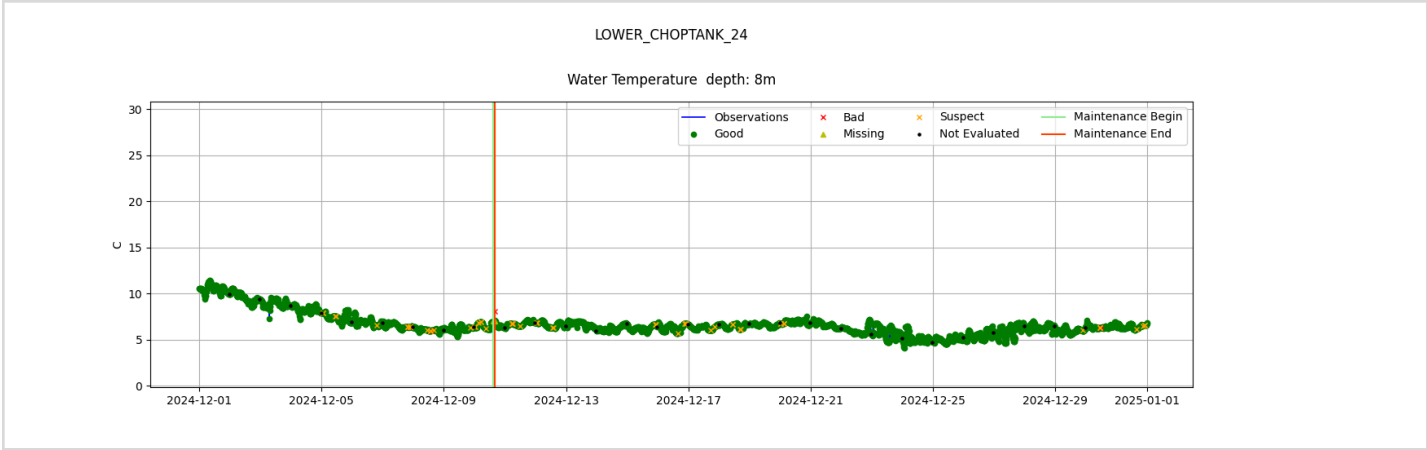




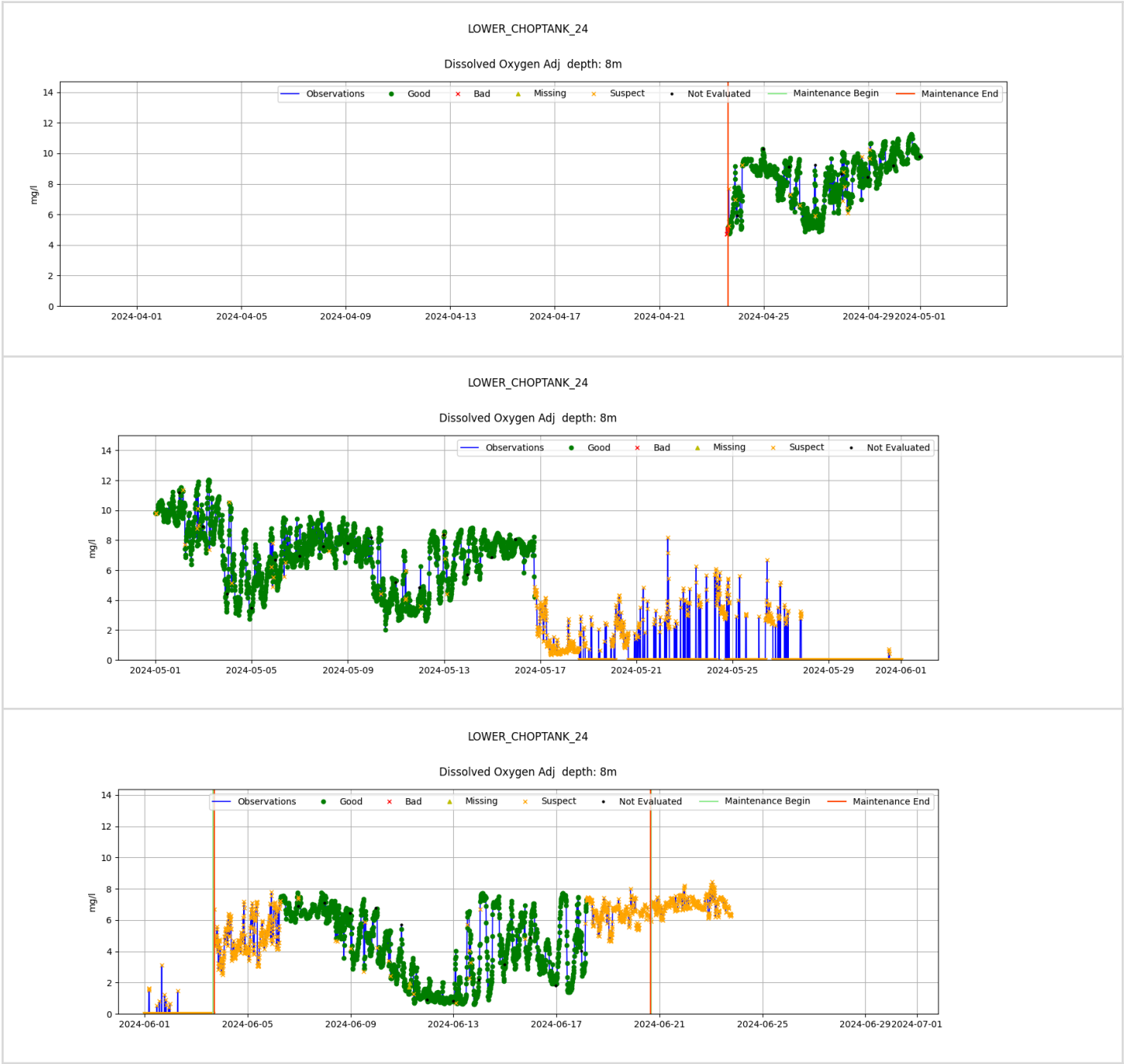


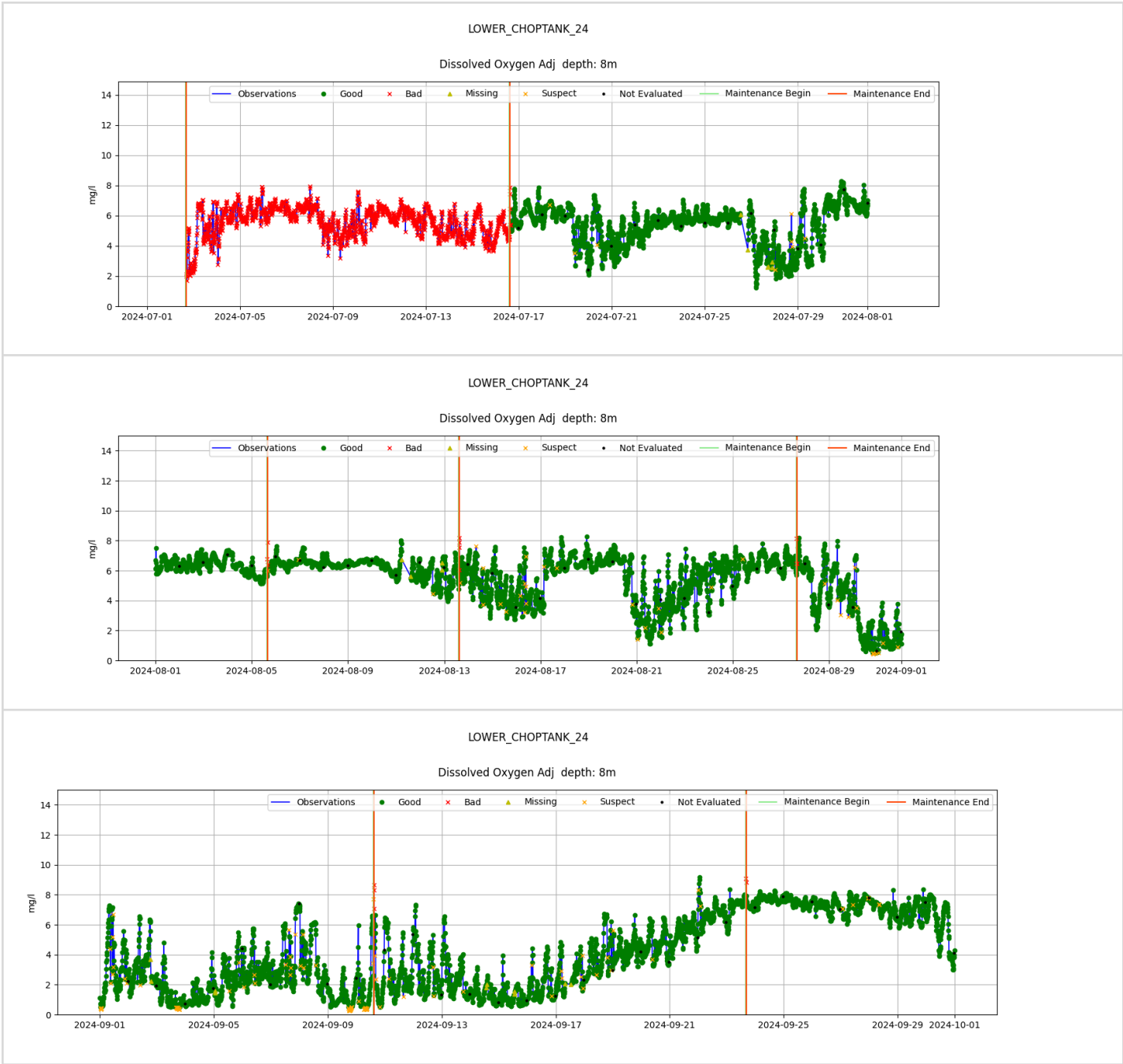


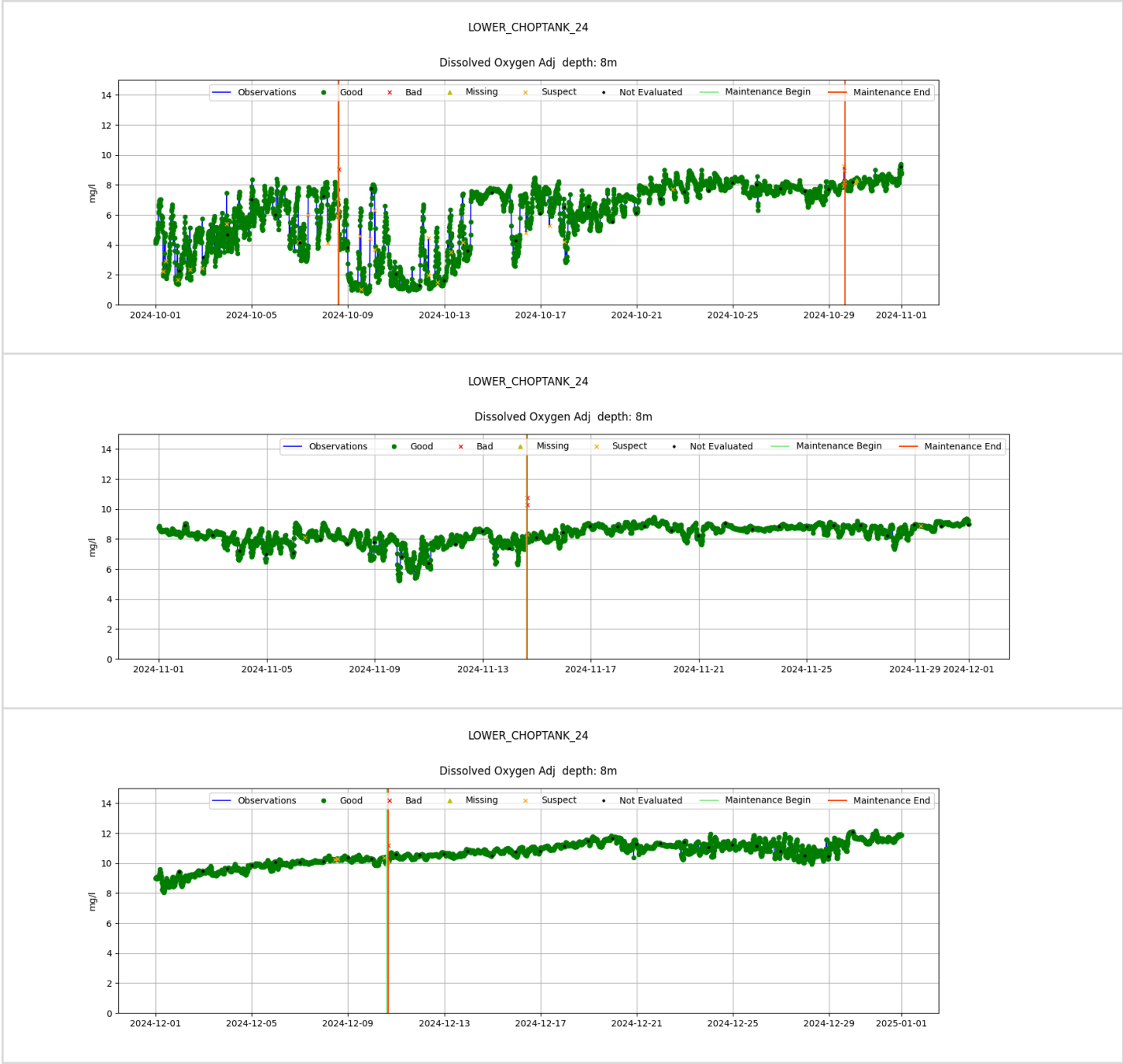




Lower Choptank 8m Dissolved Oxygen Adjusted

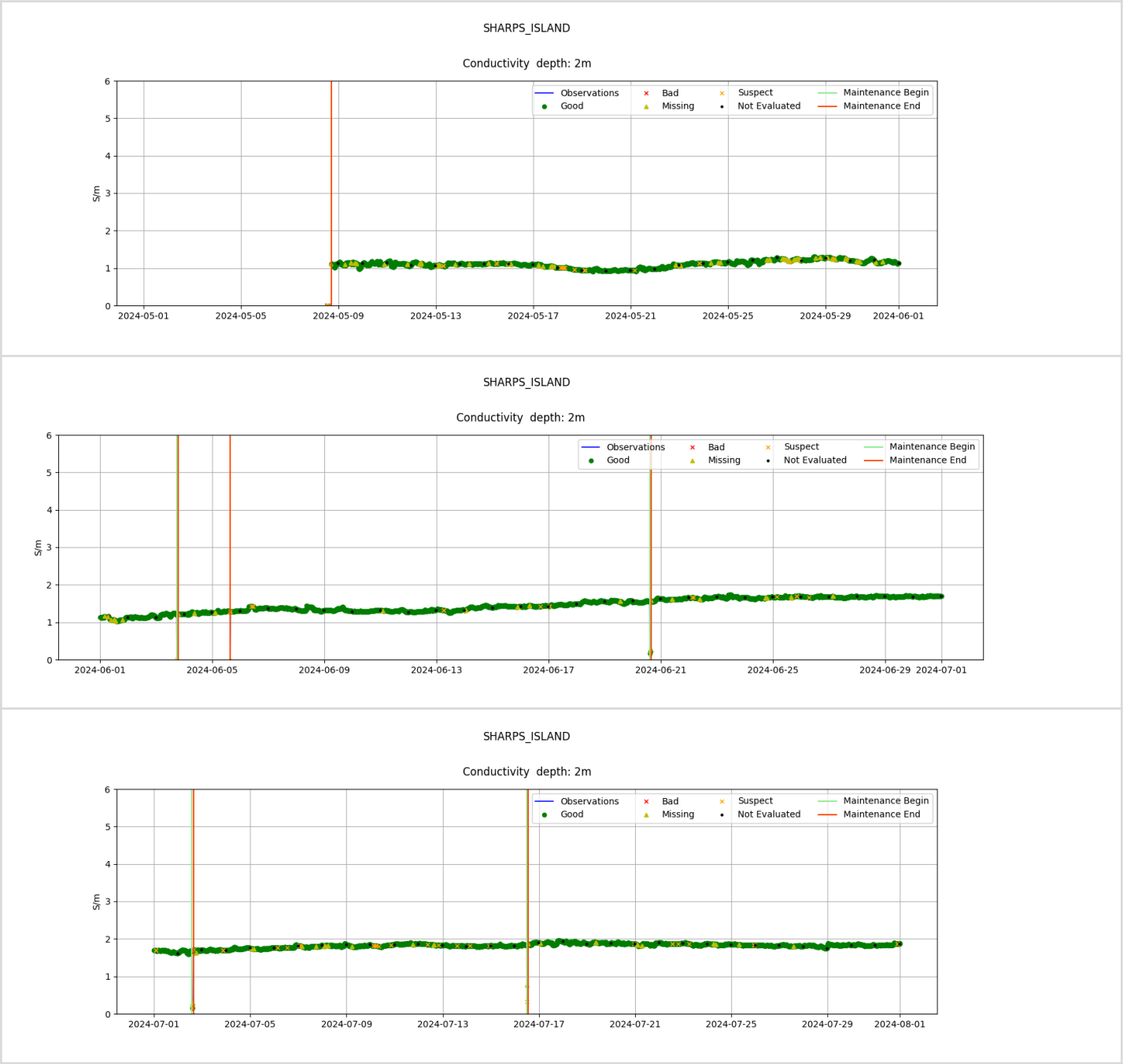




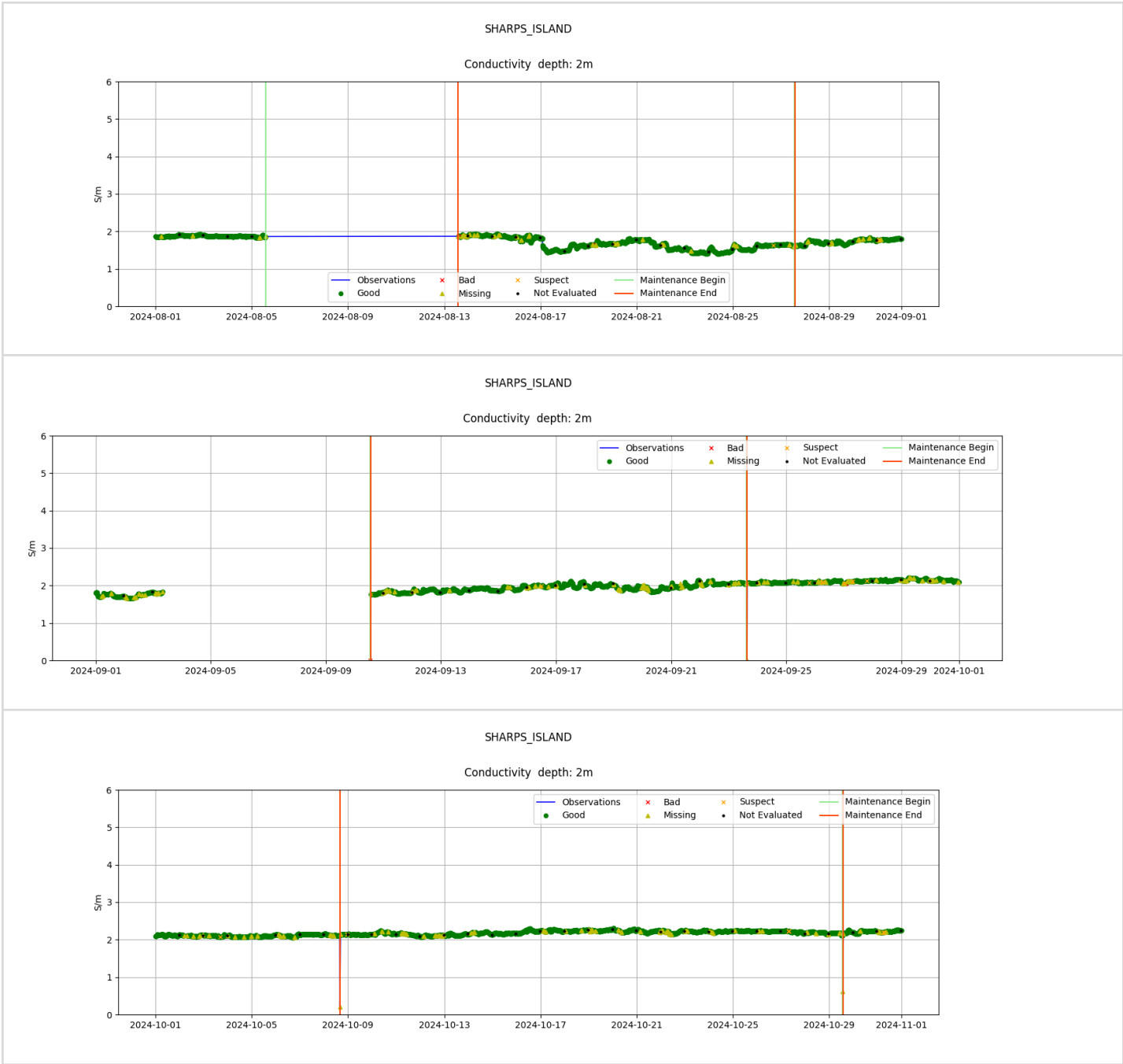


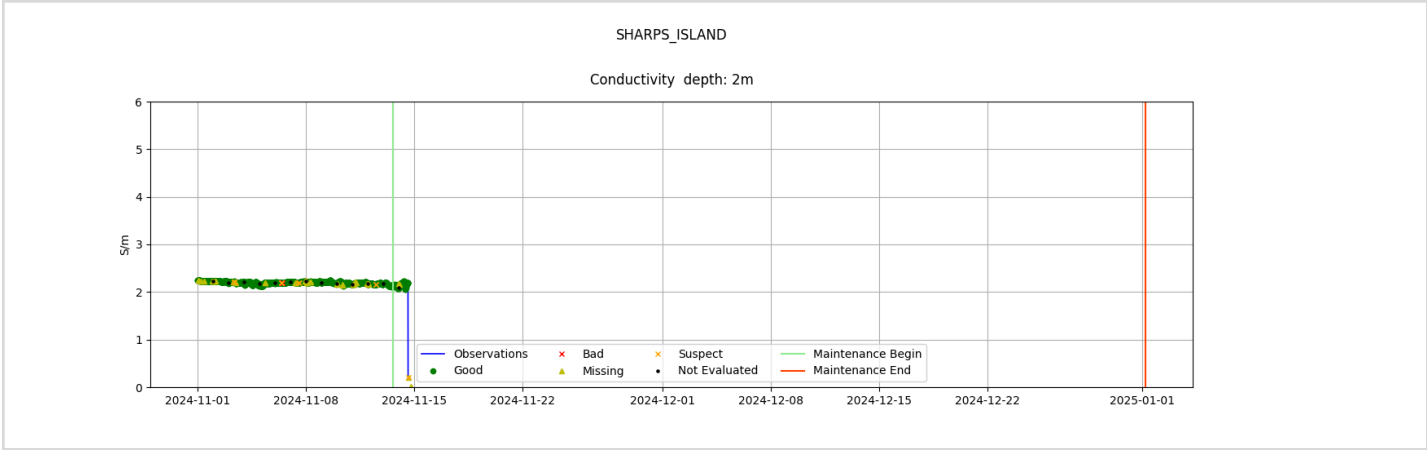
### 8.3 Sharps Island

#### Sharps Island 2m Conductivity

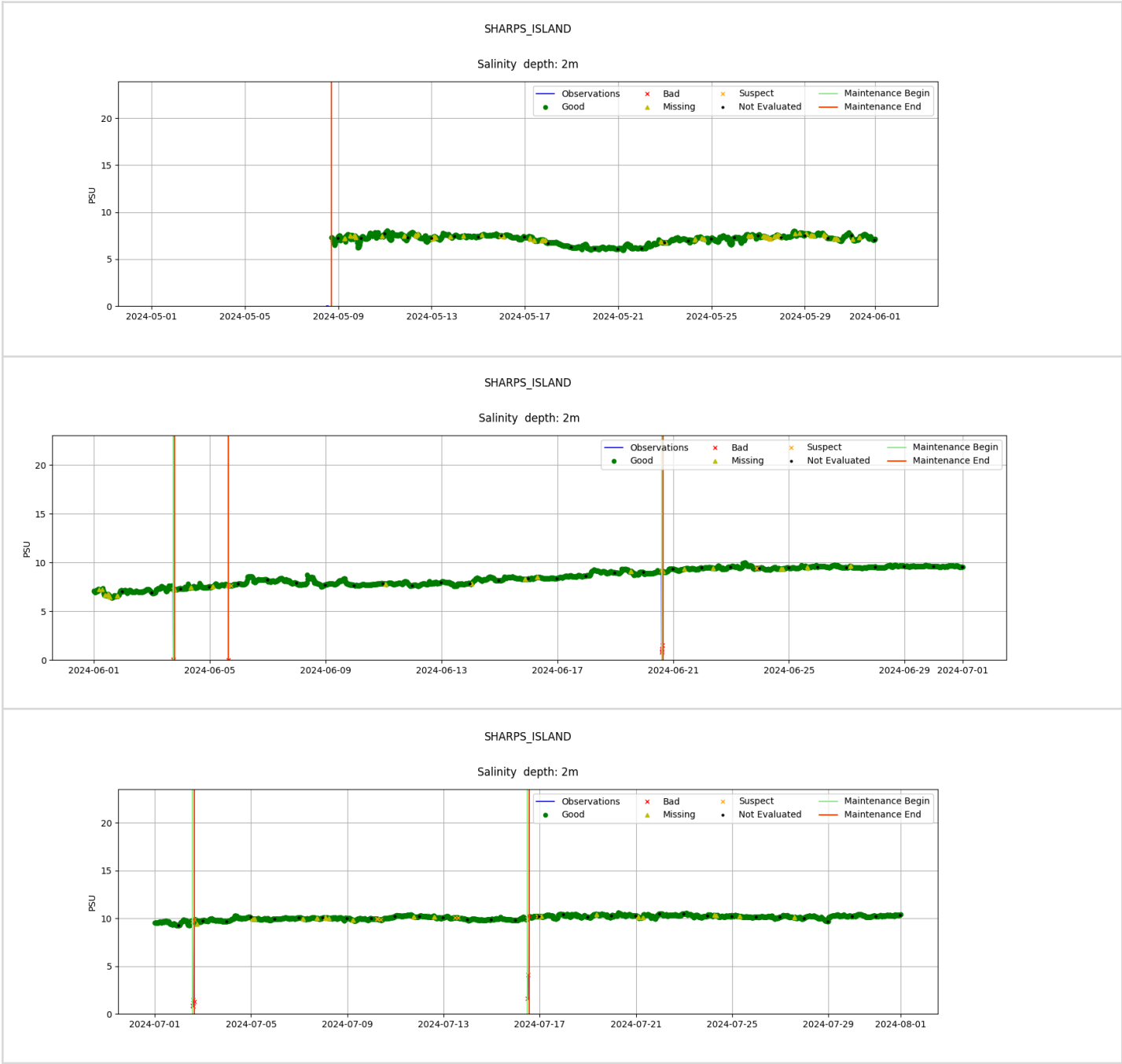


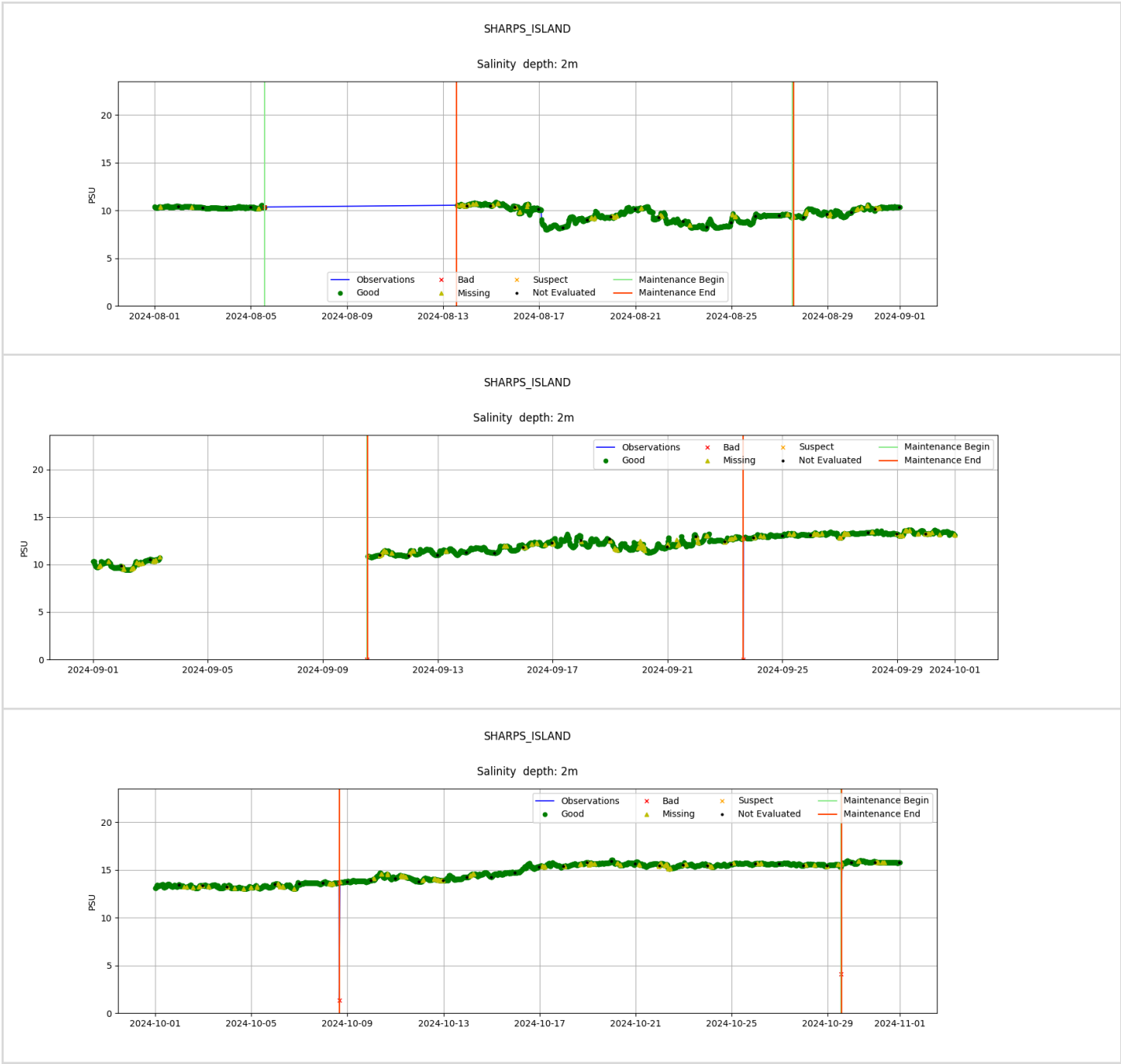


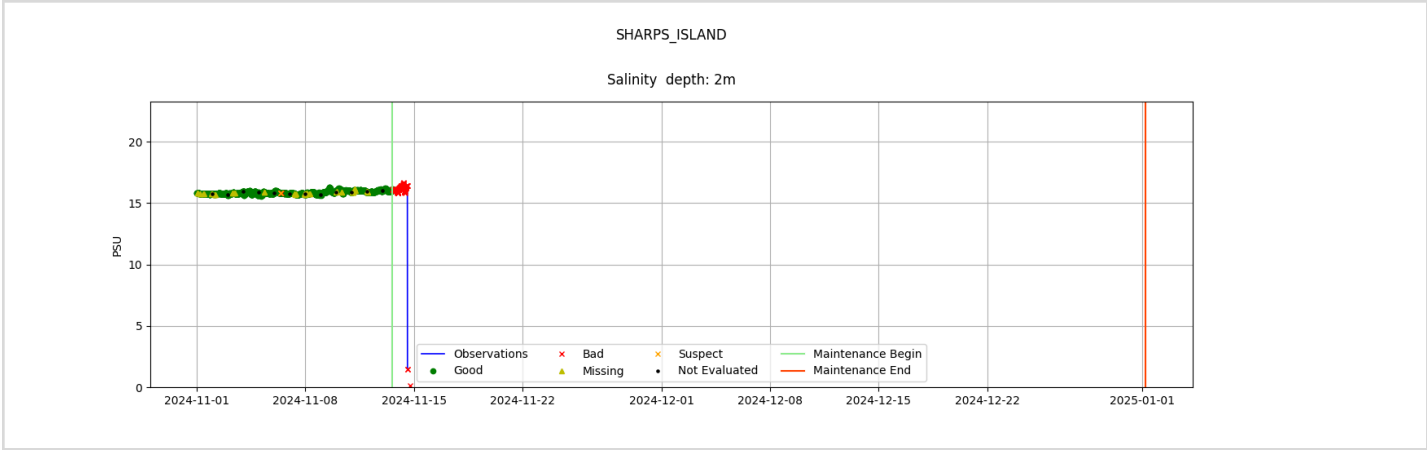




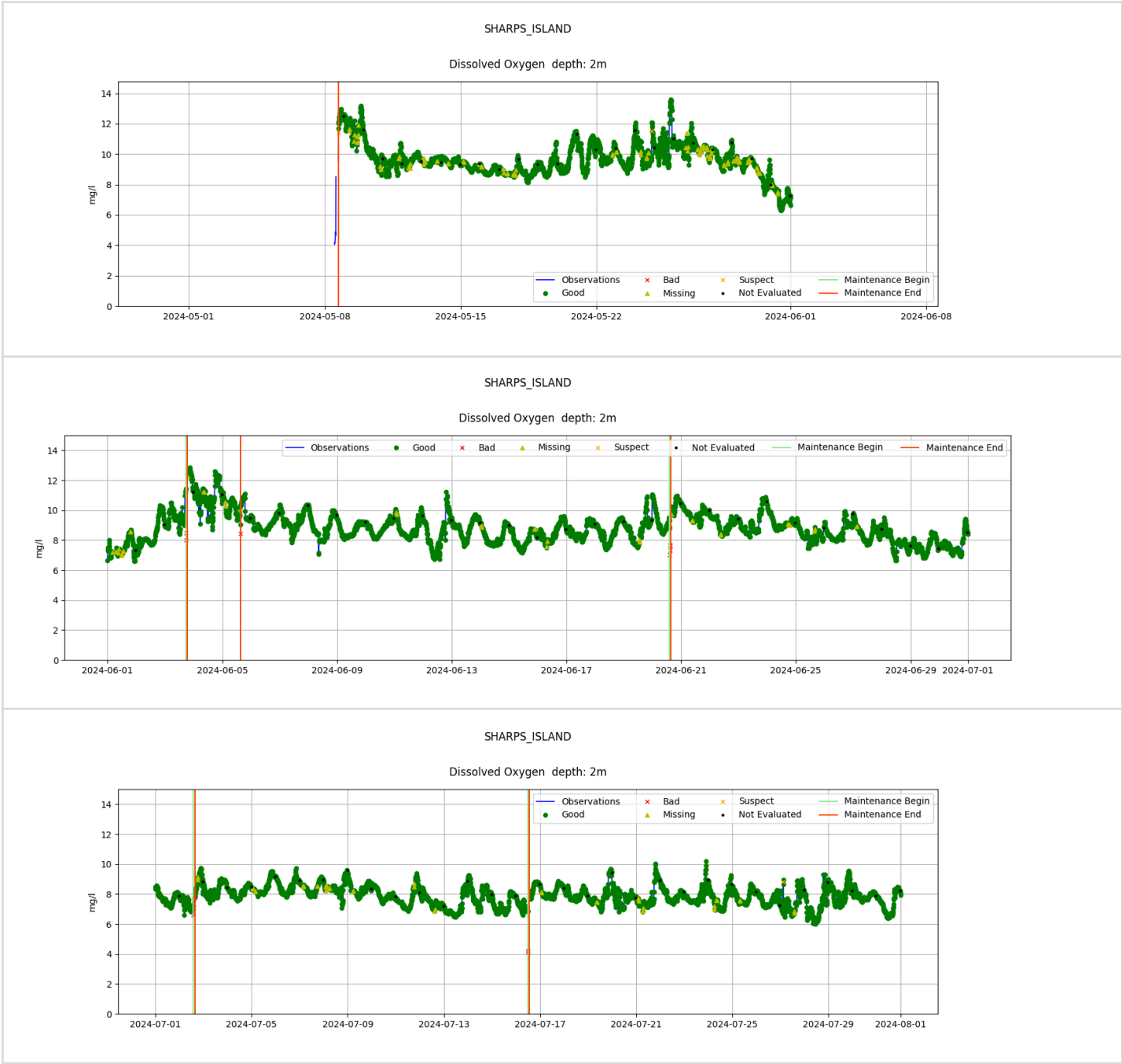
Sharps Island 2m Salinity



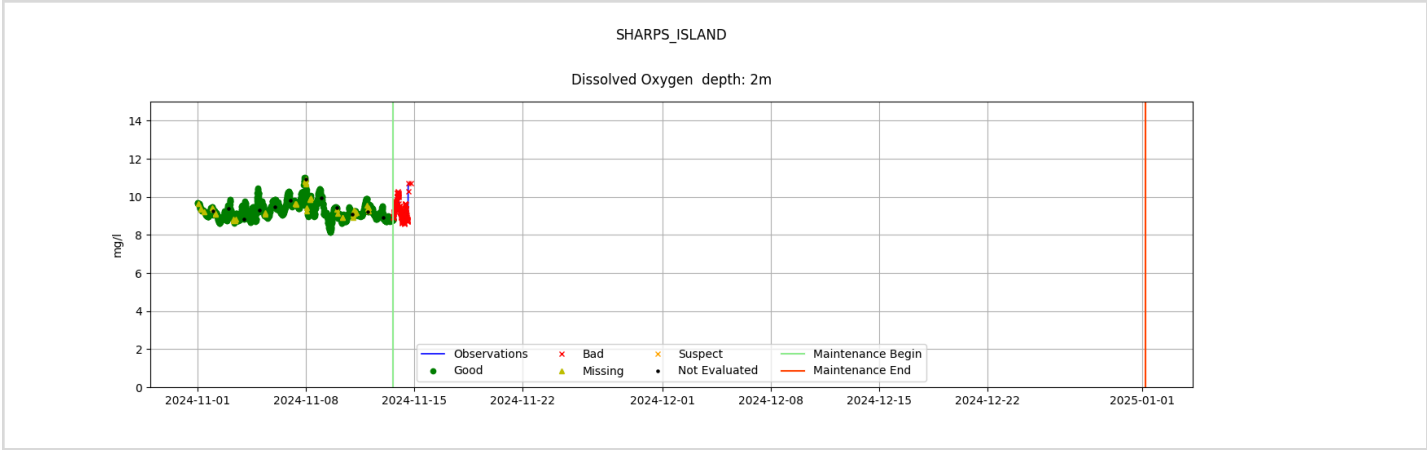




Sharps Island 2m Dissolved Oxygen

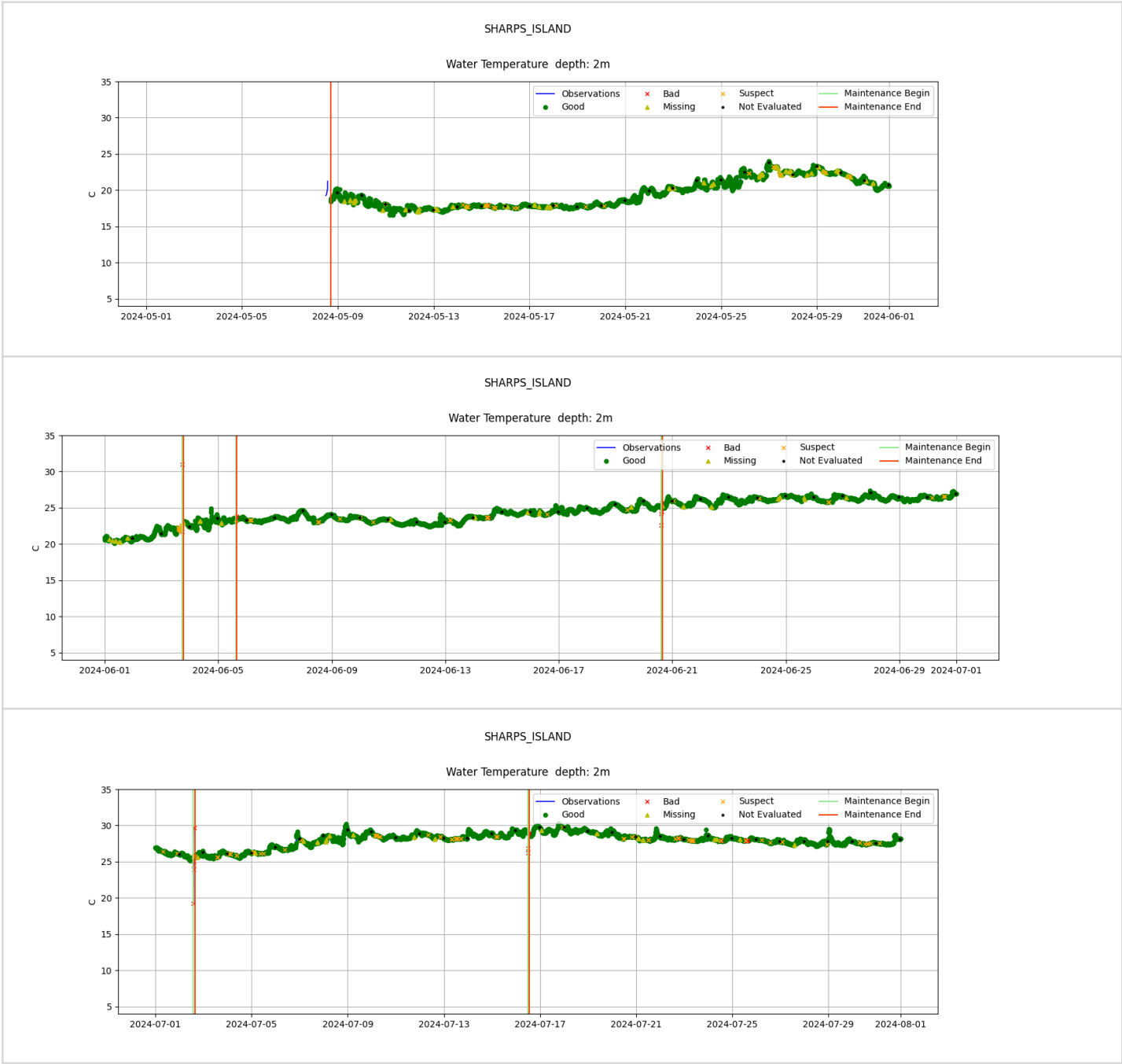


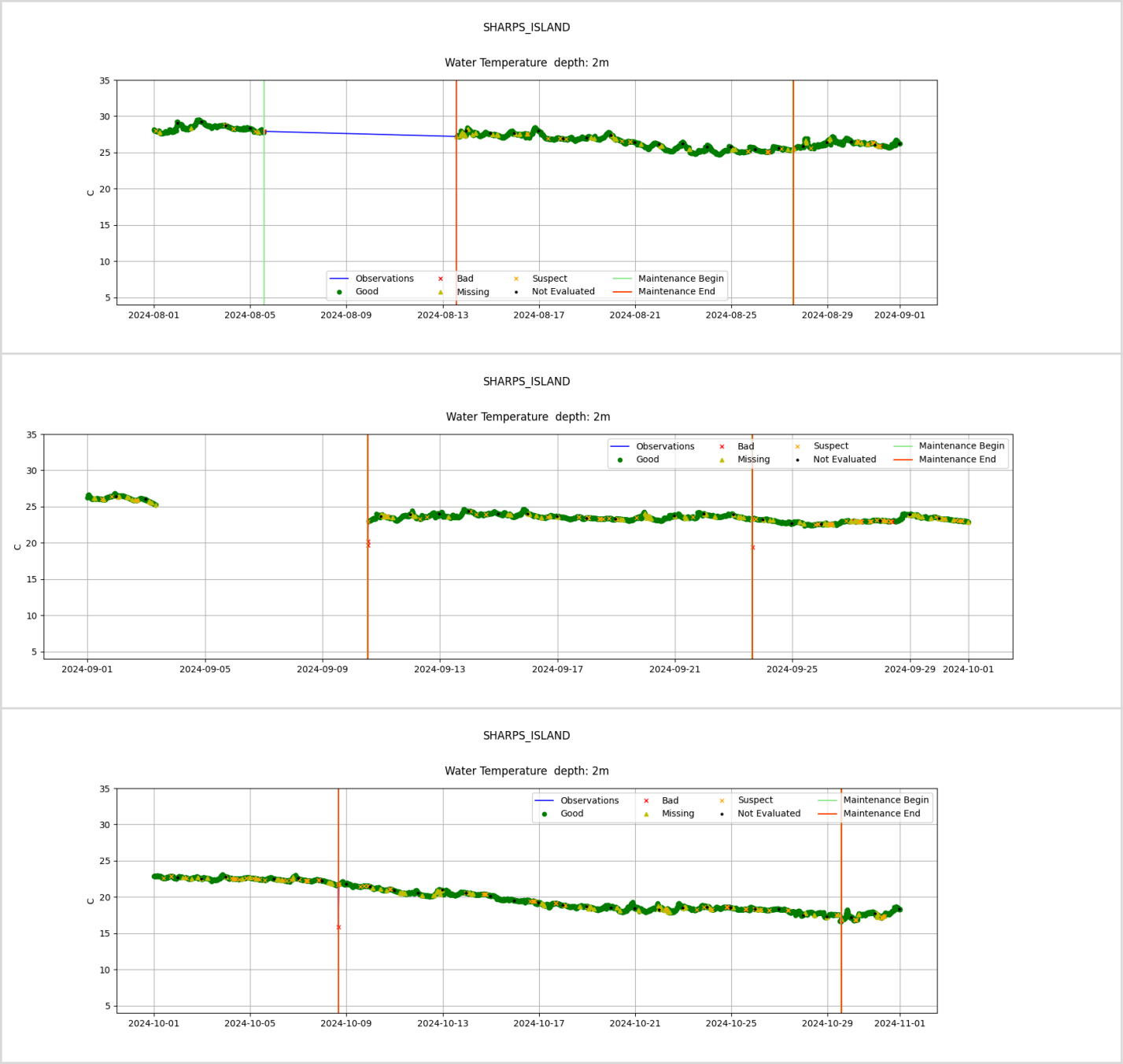


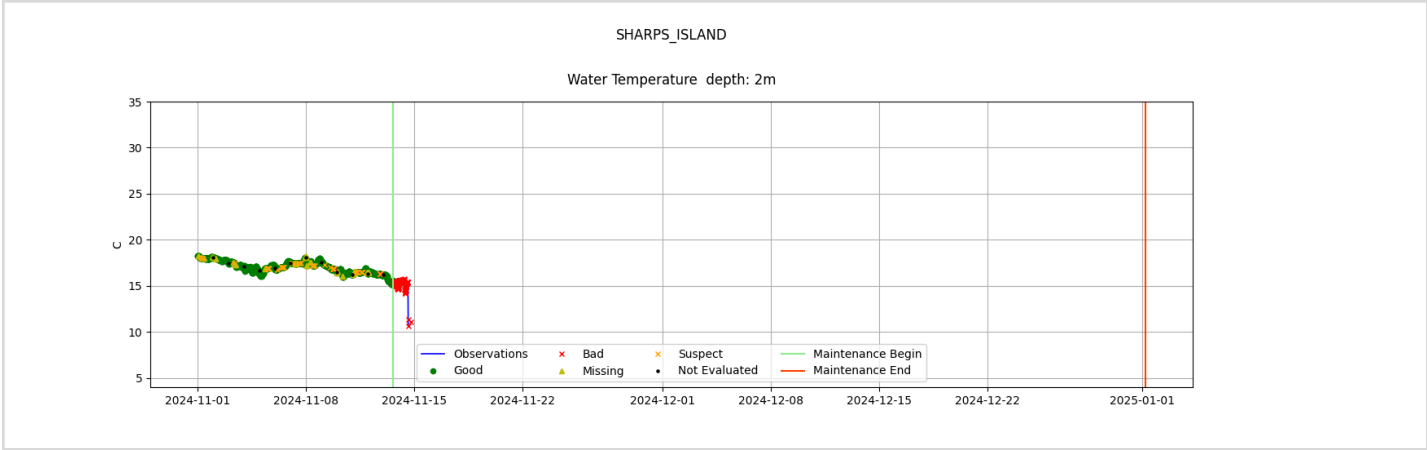




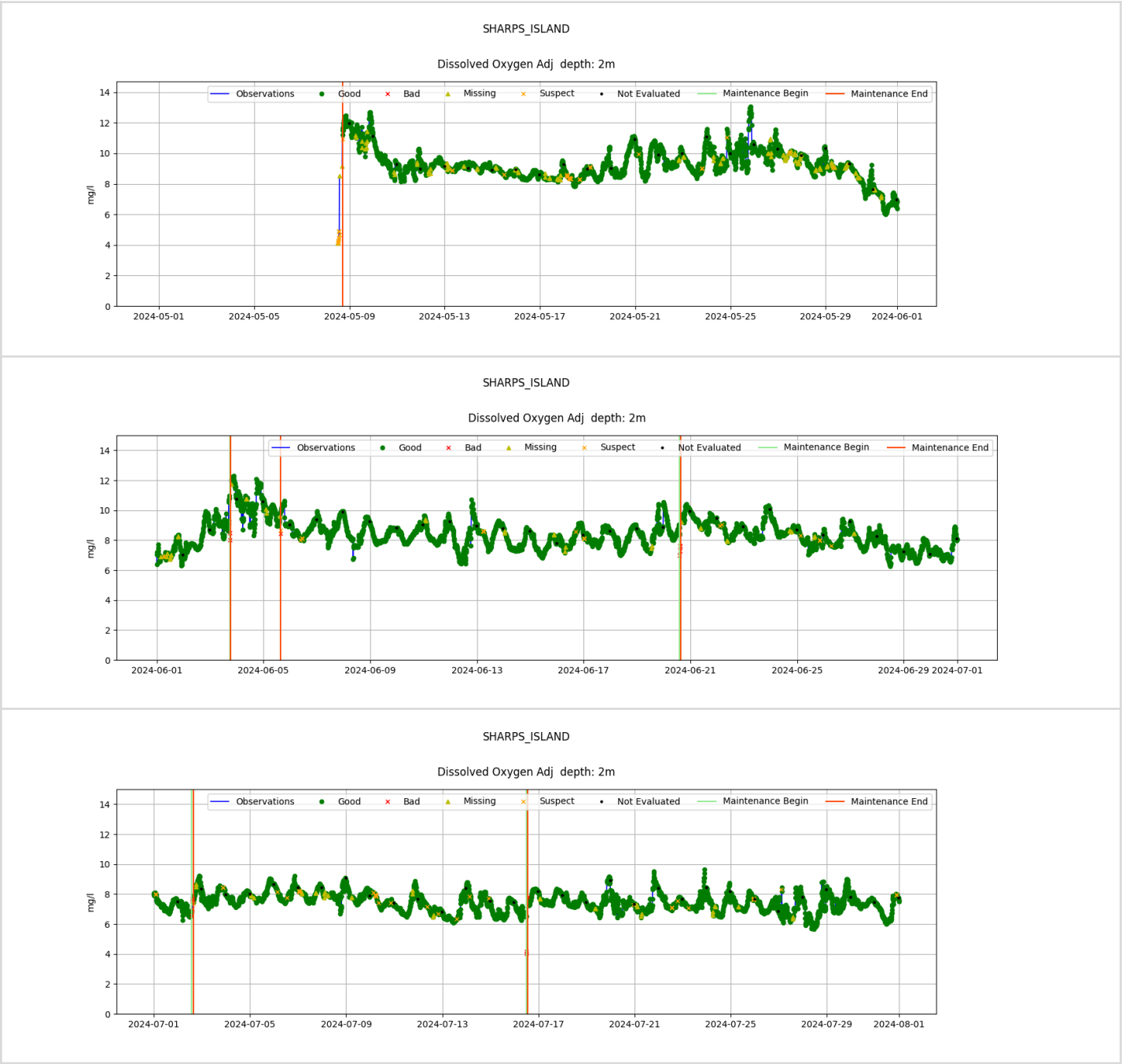
Sharps Island 2m Water Temperature



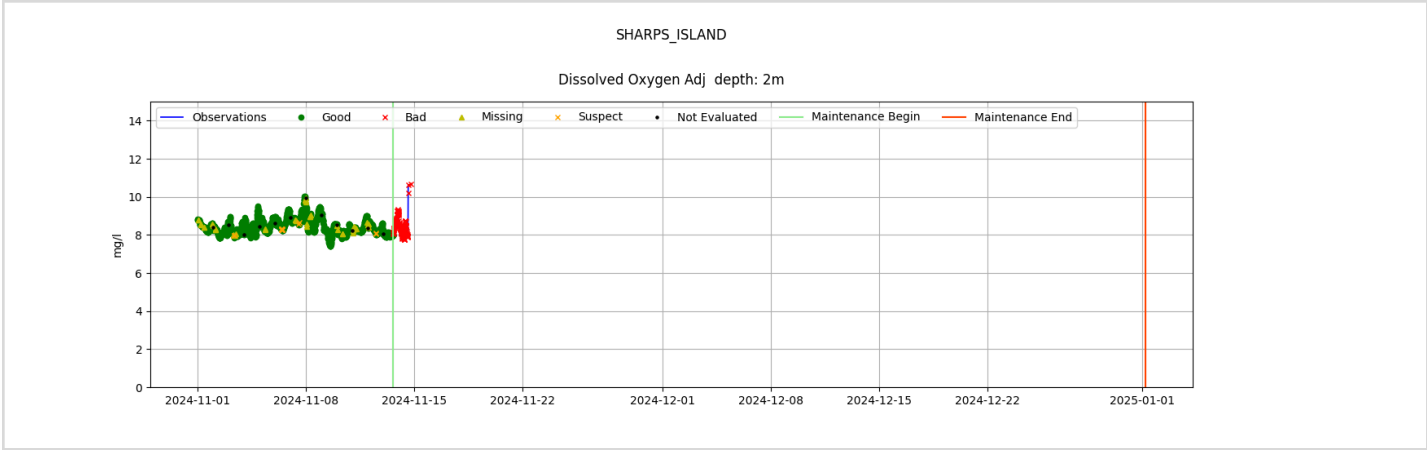




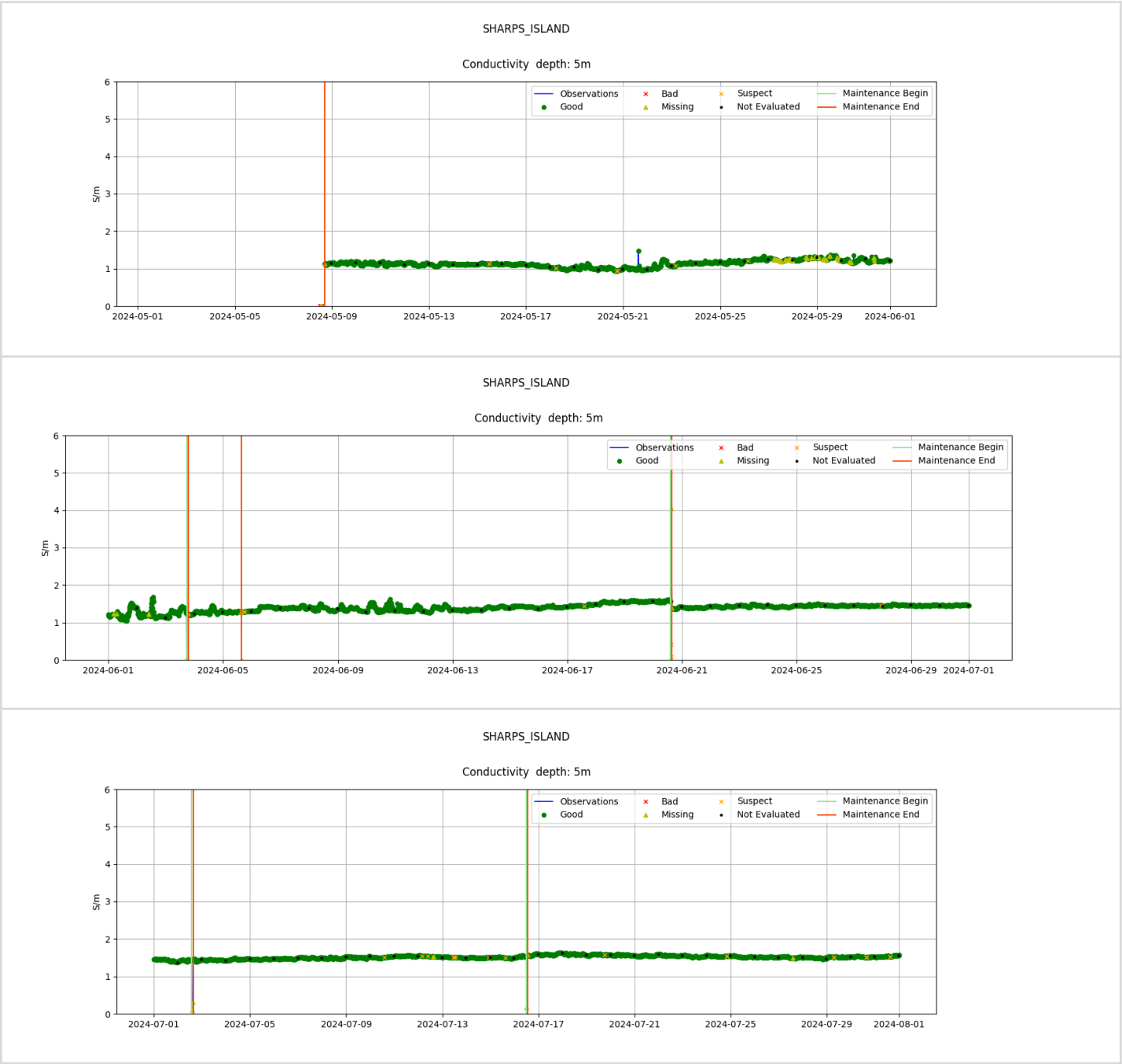
Sharps Island 2m Dissolved Oxygen Adjusted

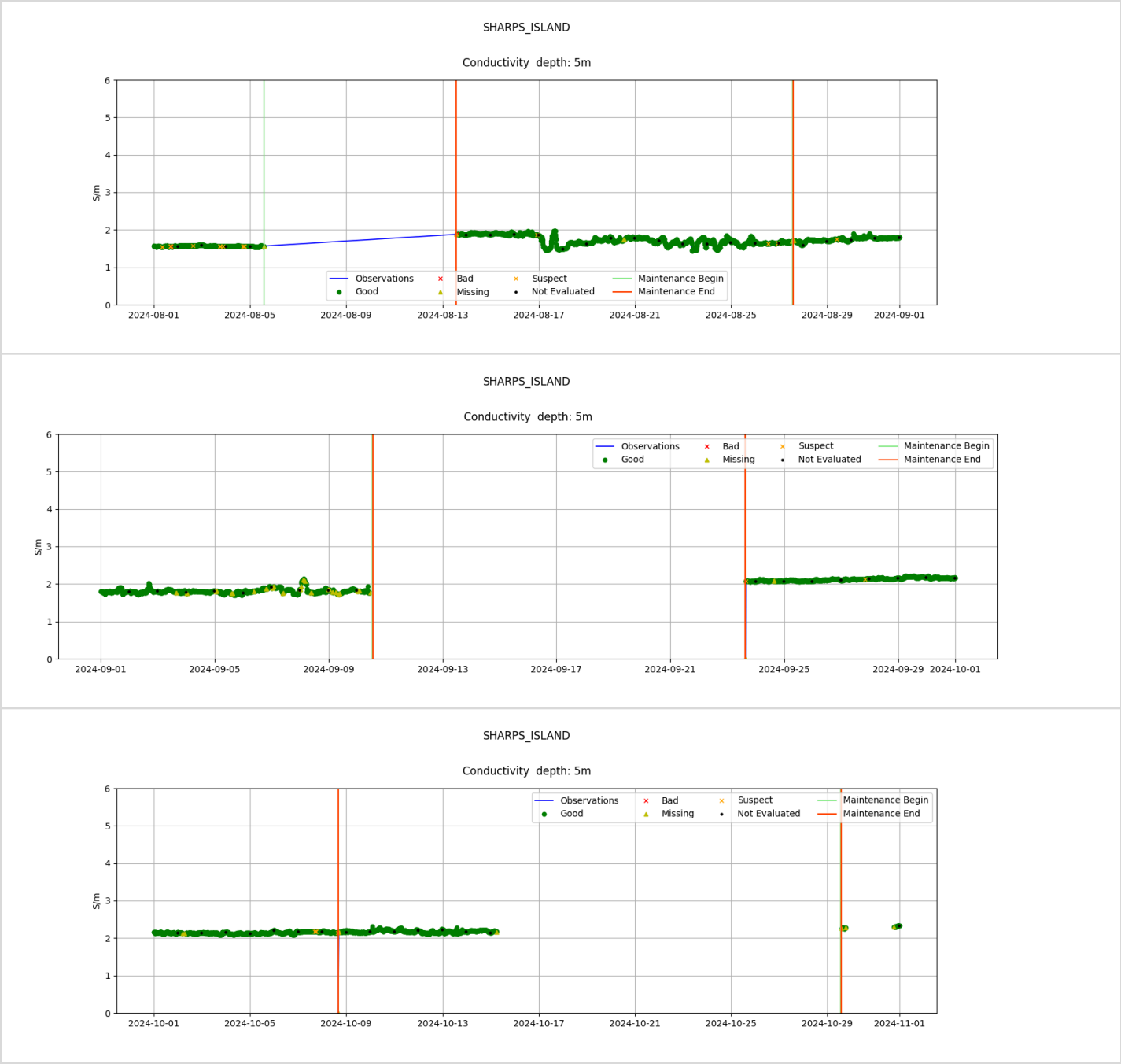




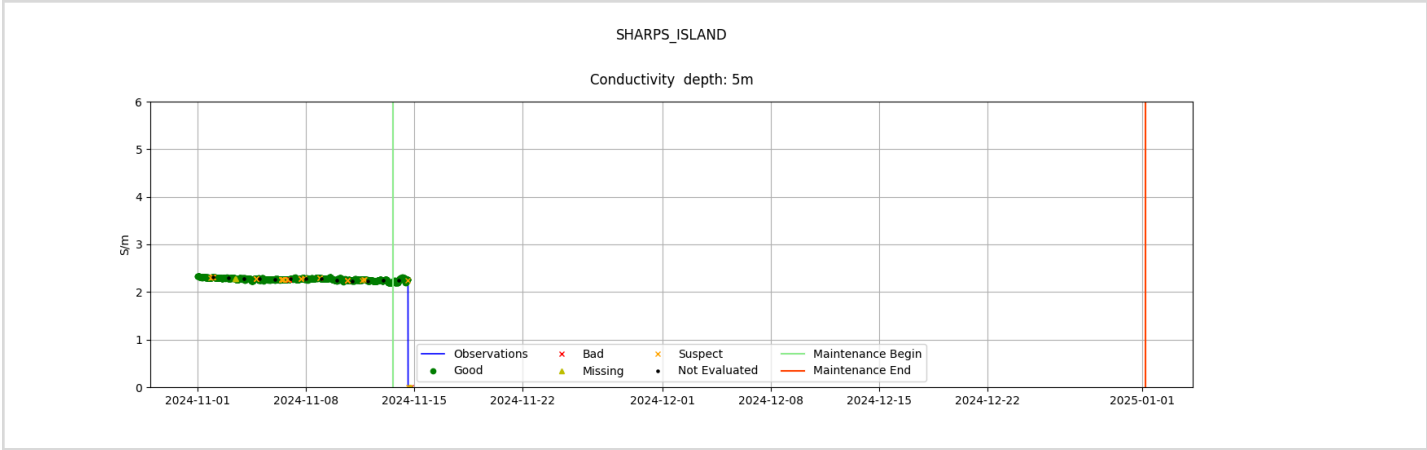


Sharps Island 5m Conductivity

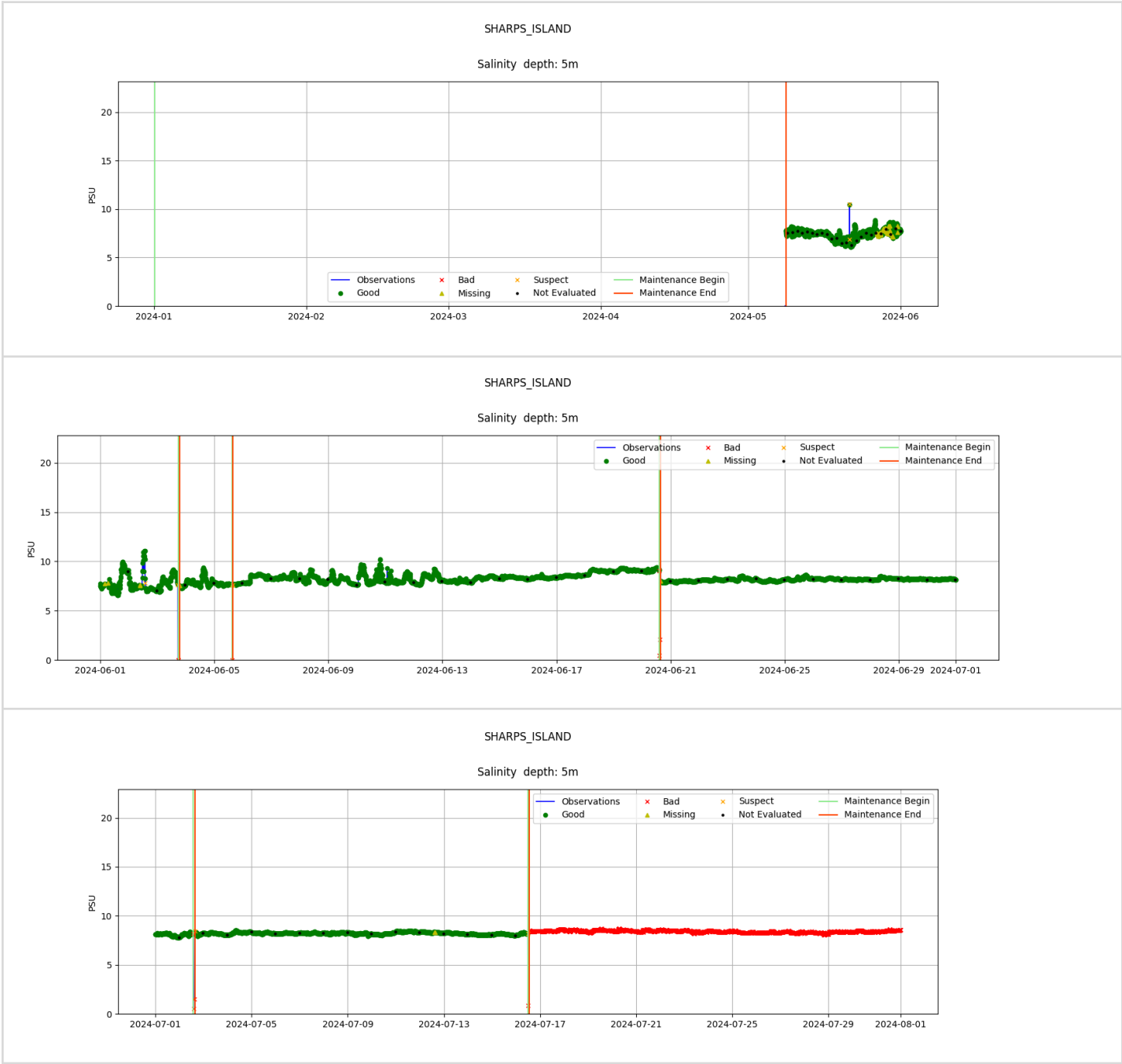


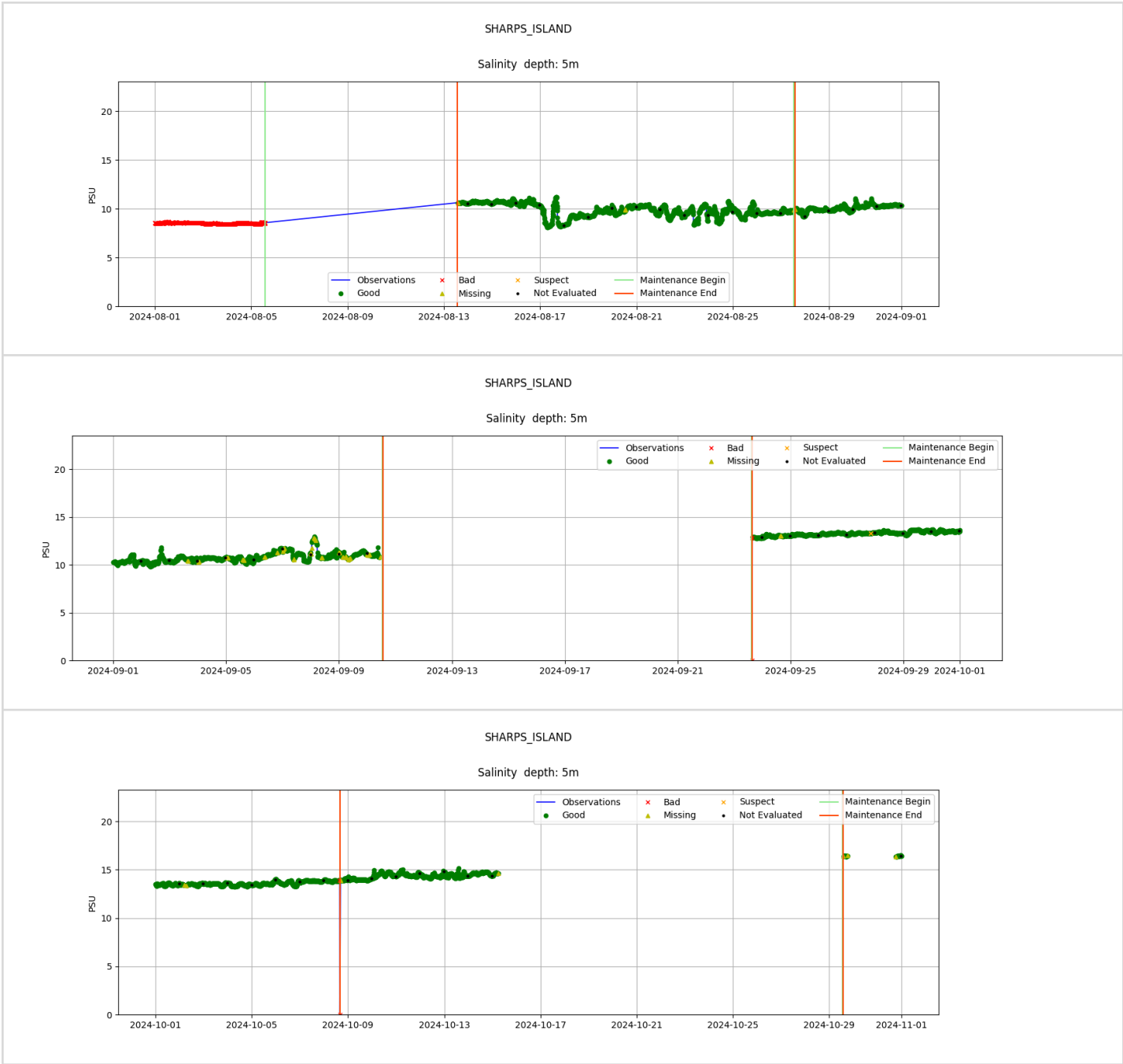


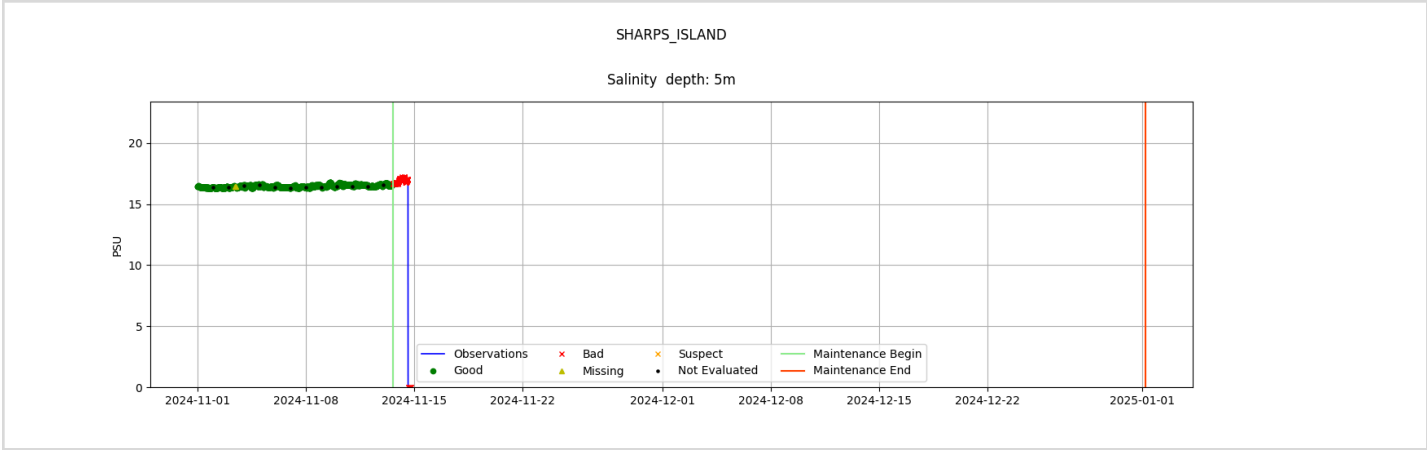




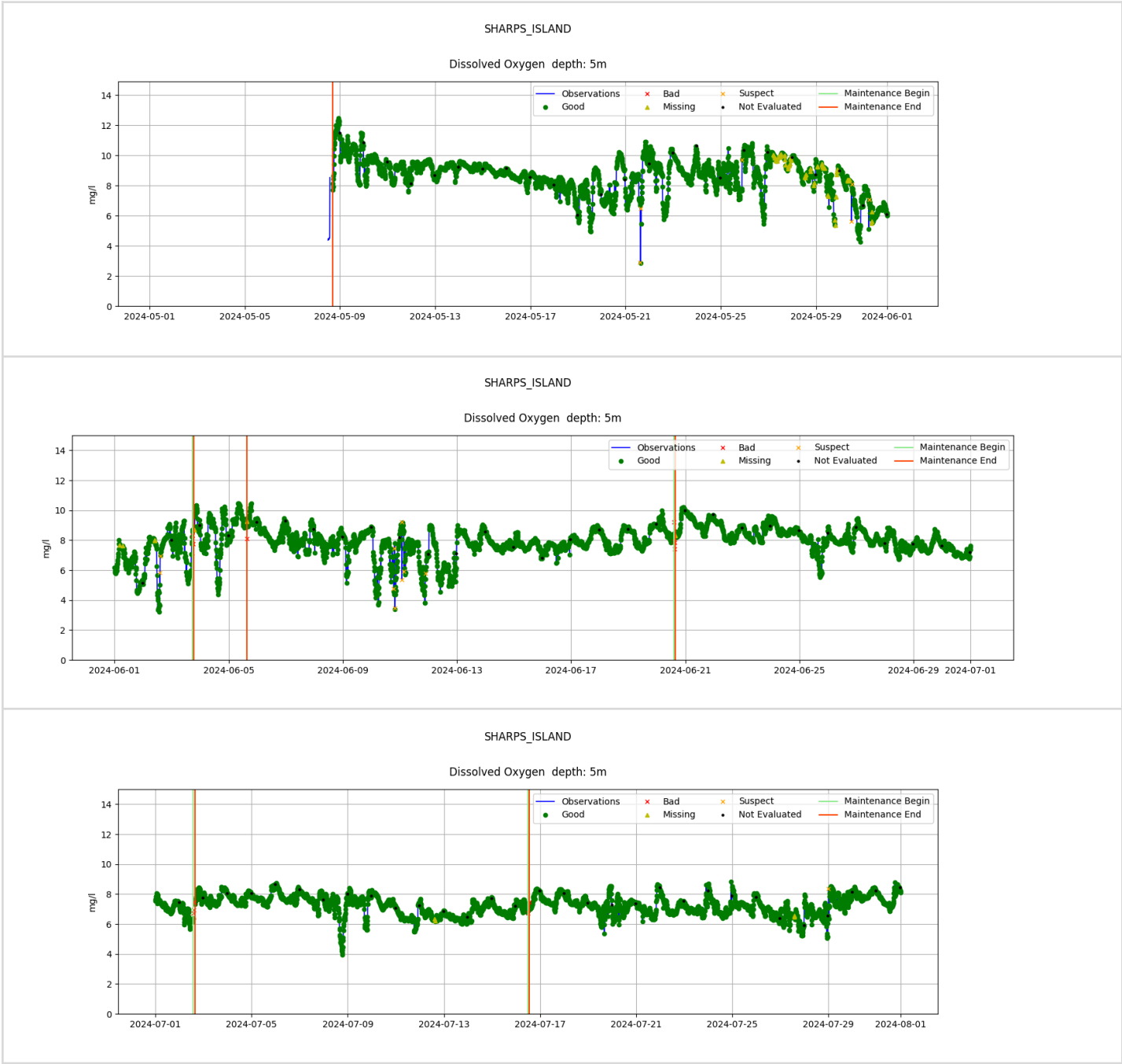
Sharps Island 5m Salinity



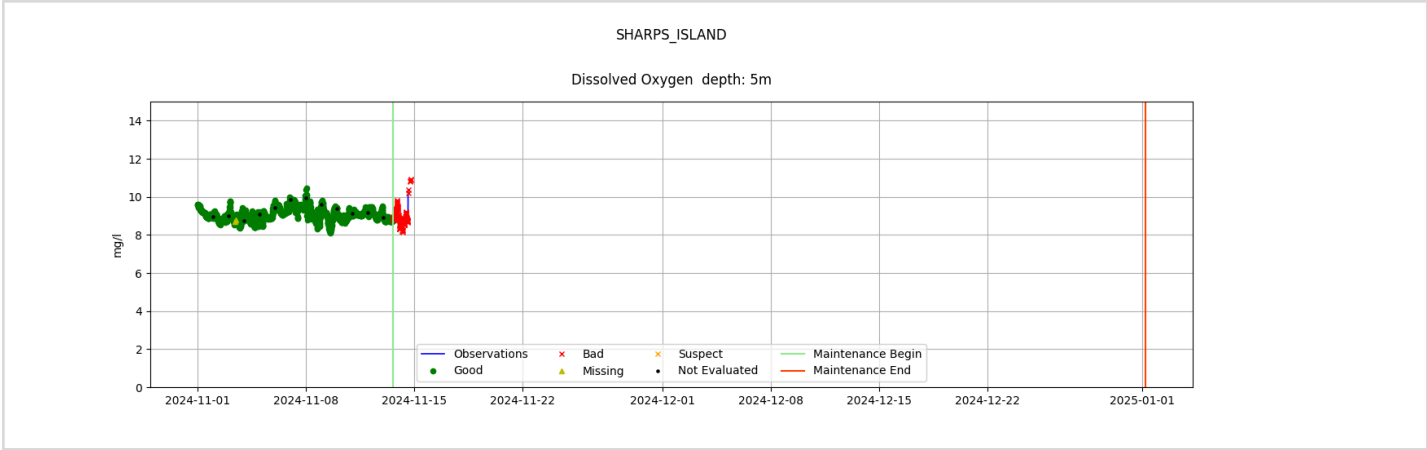




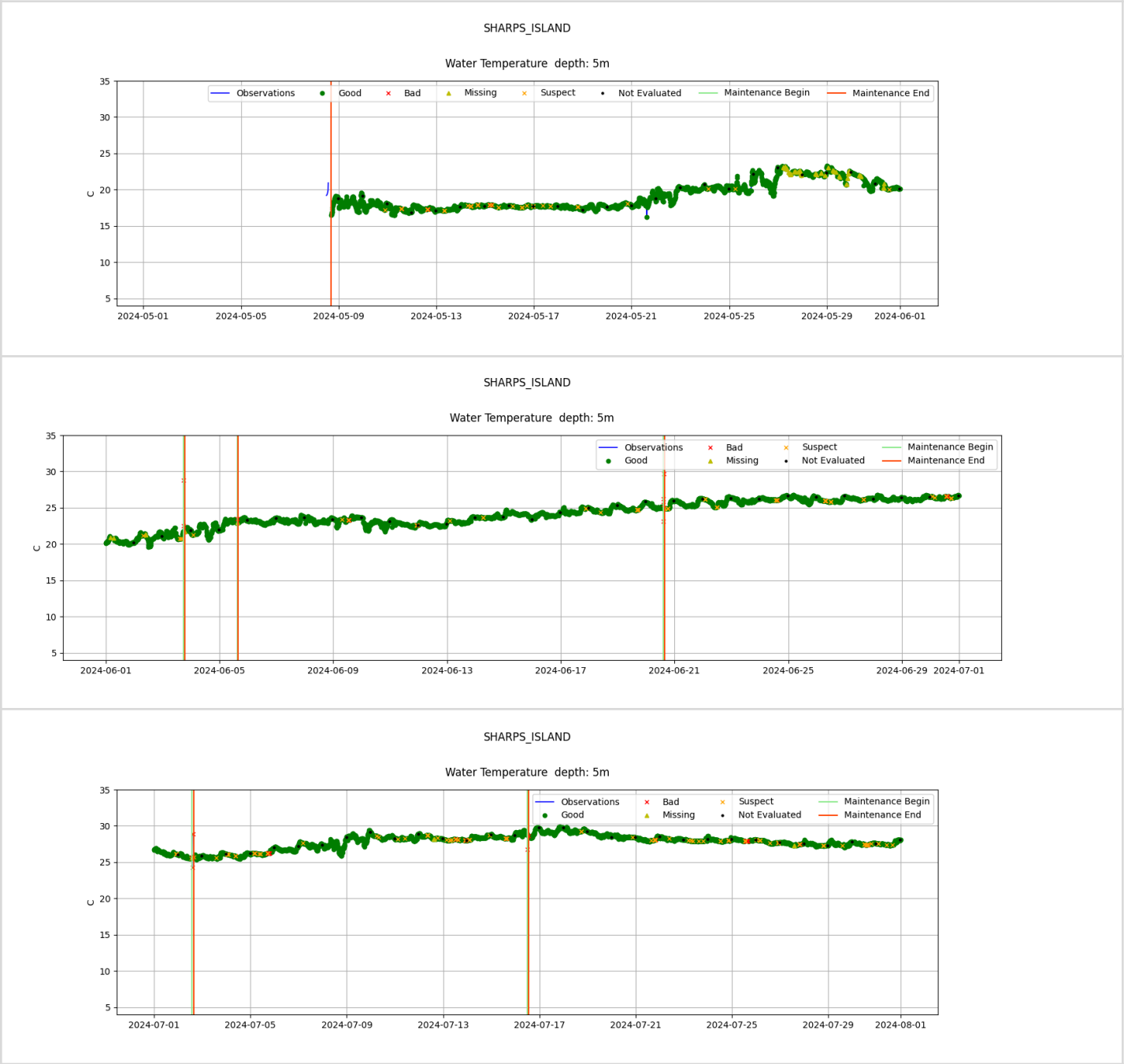
Sharps Island 5m Dissolved Oxygen



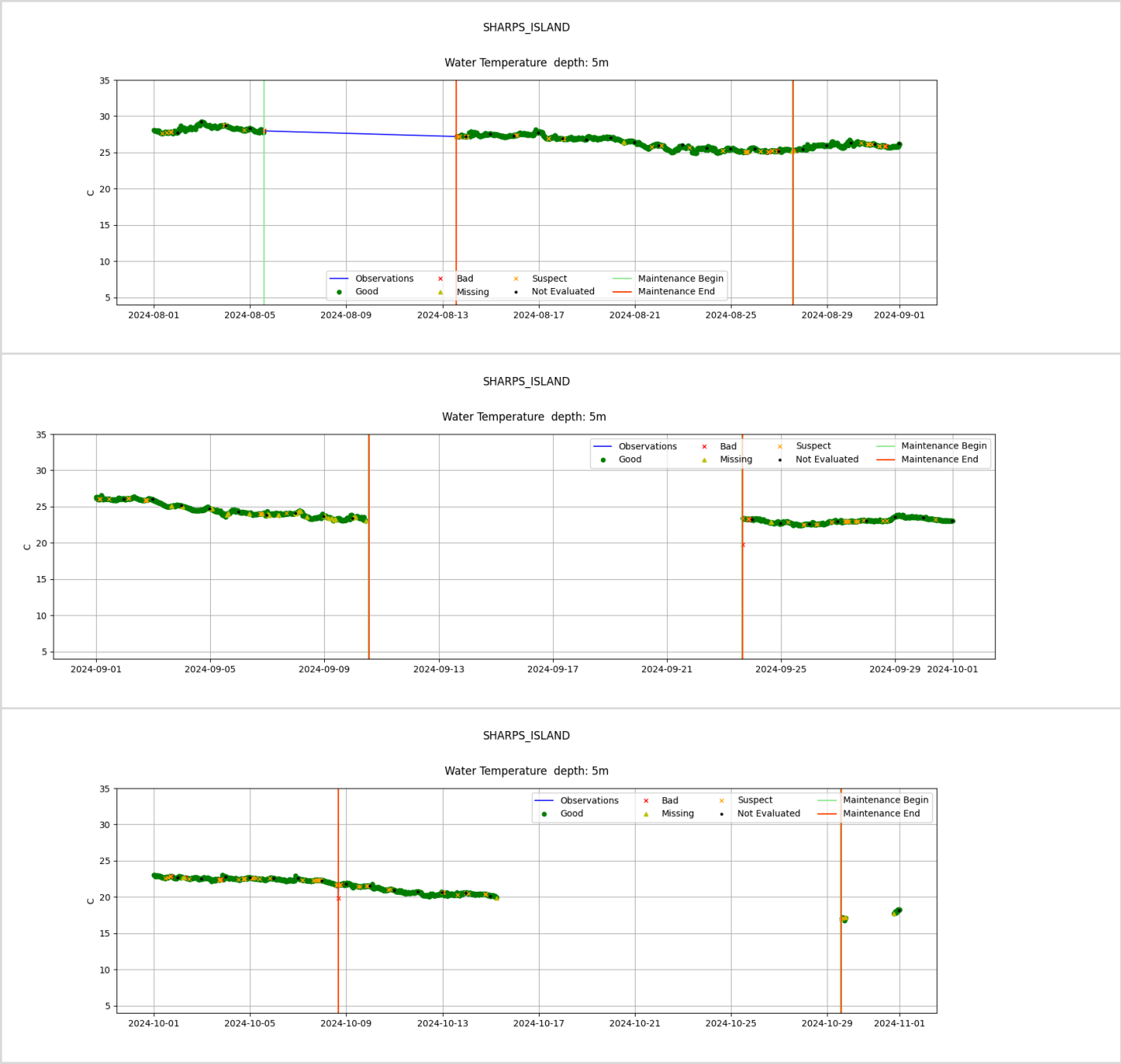


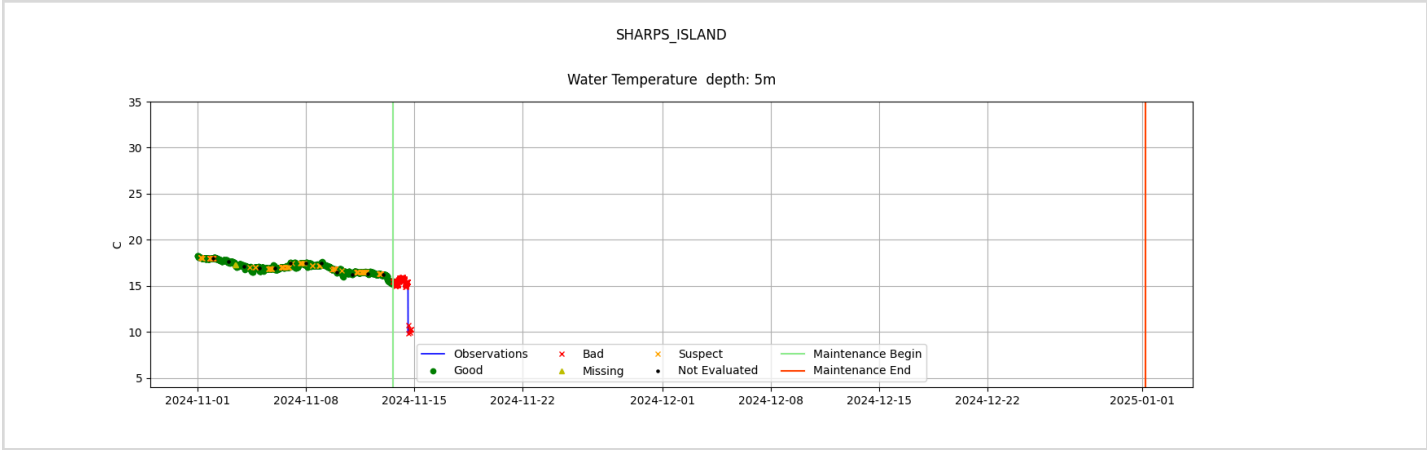


Sharps Island 5m Water Temperature

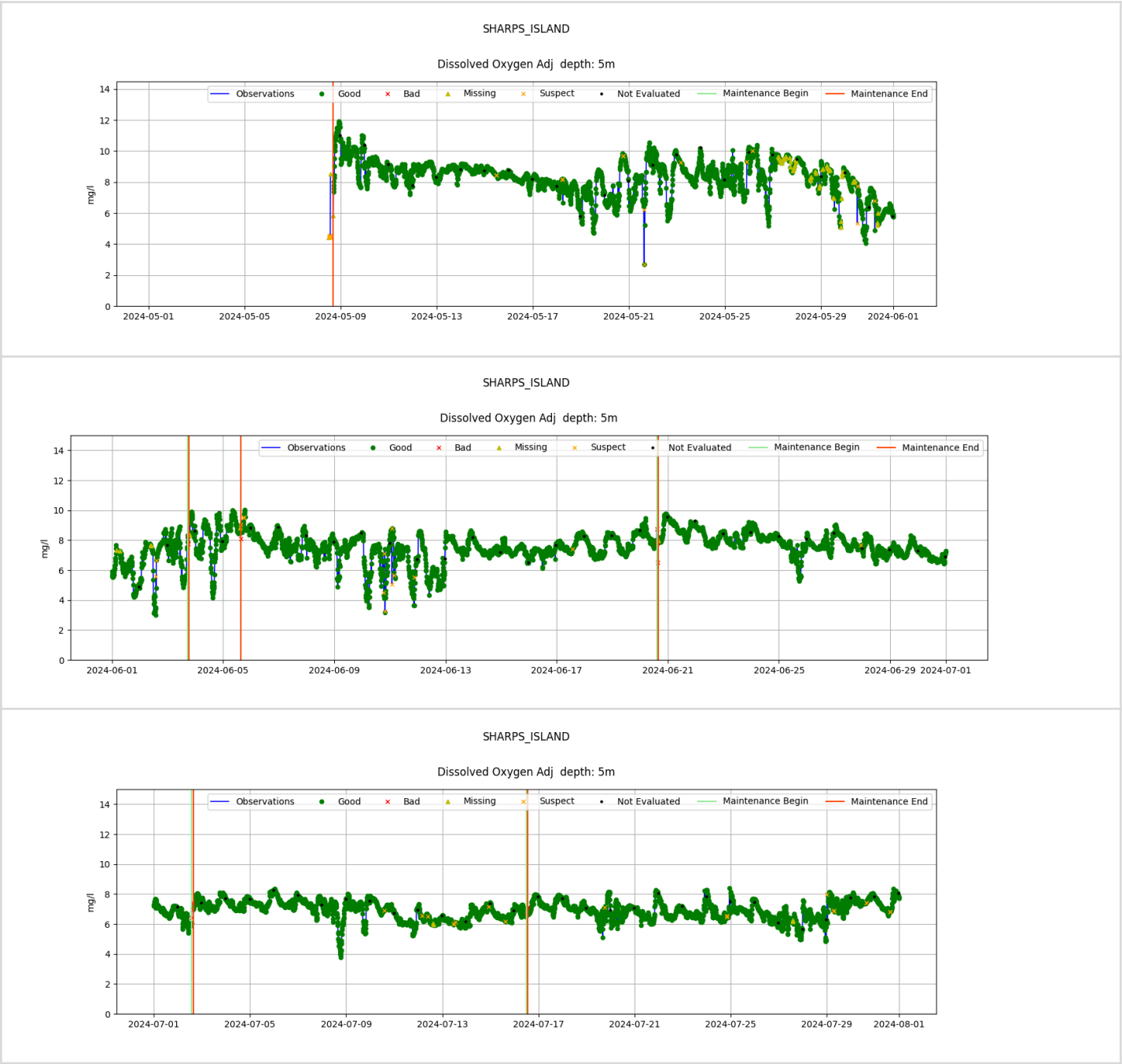




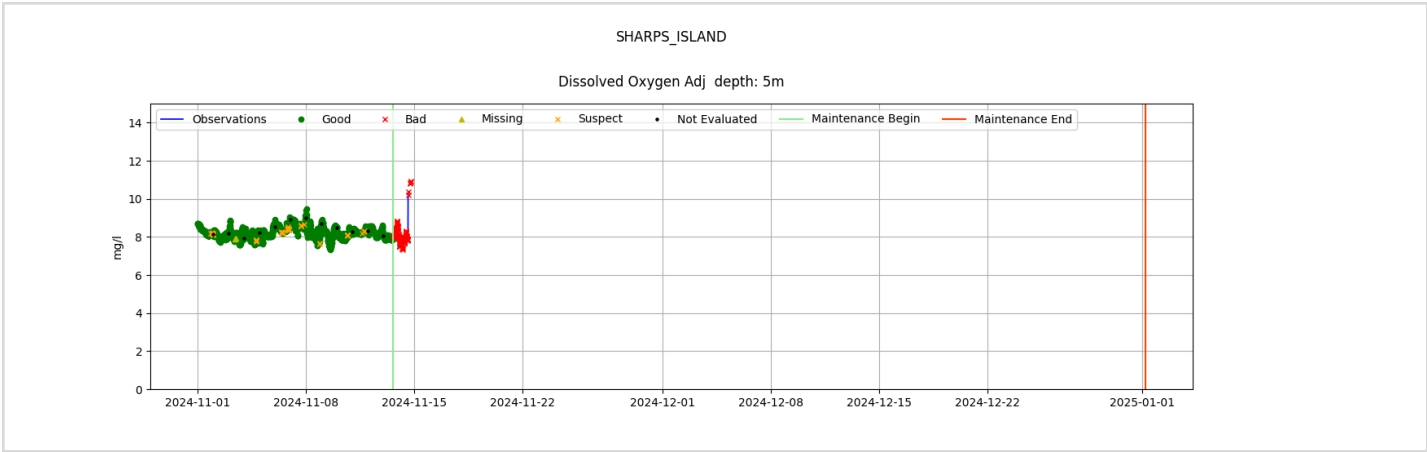




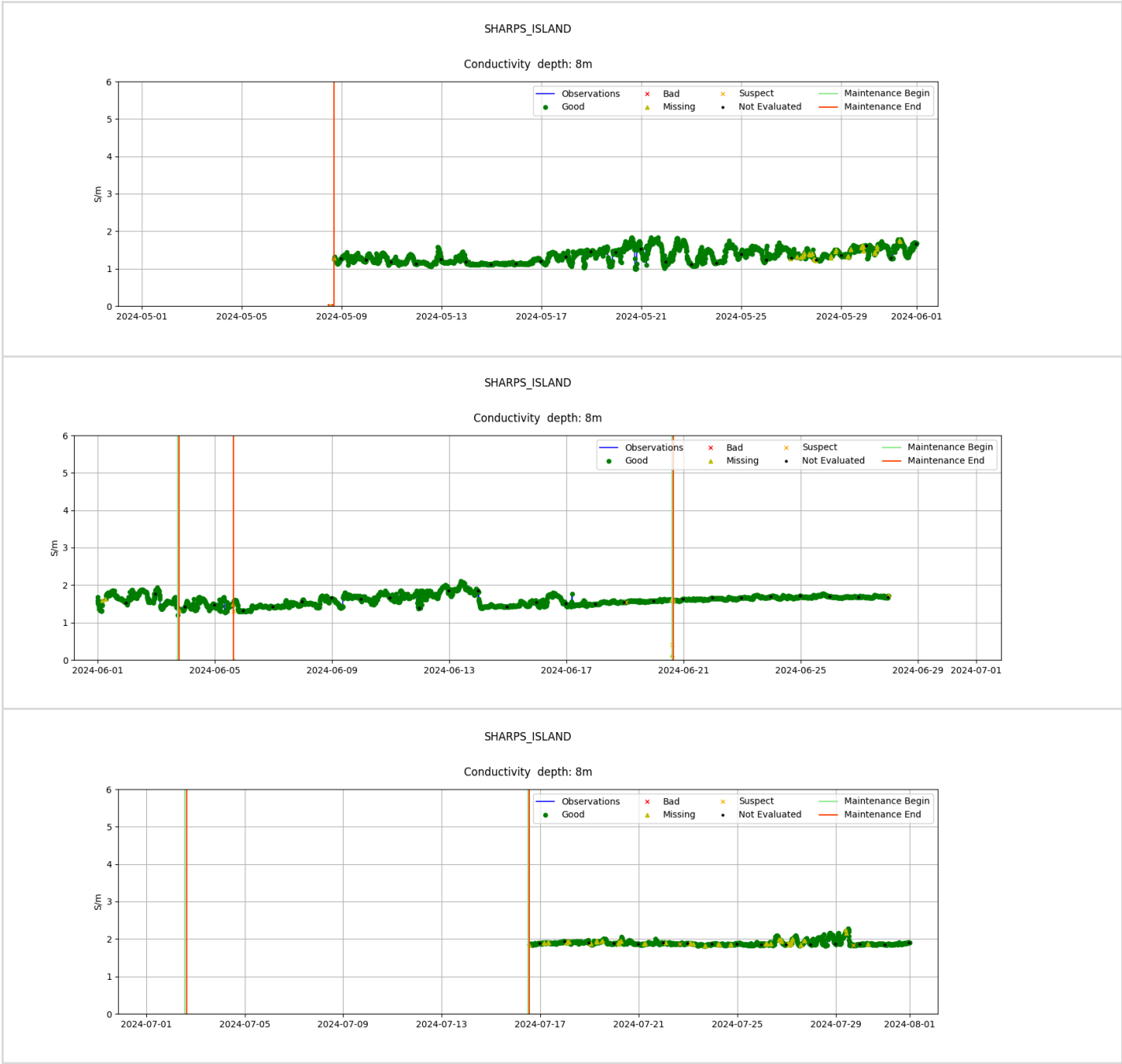
Sharps Island 5m Dissolved Oxygen Adjusted

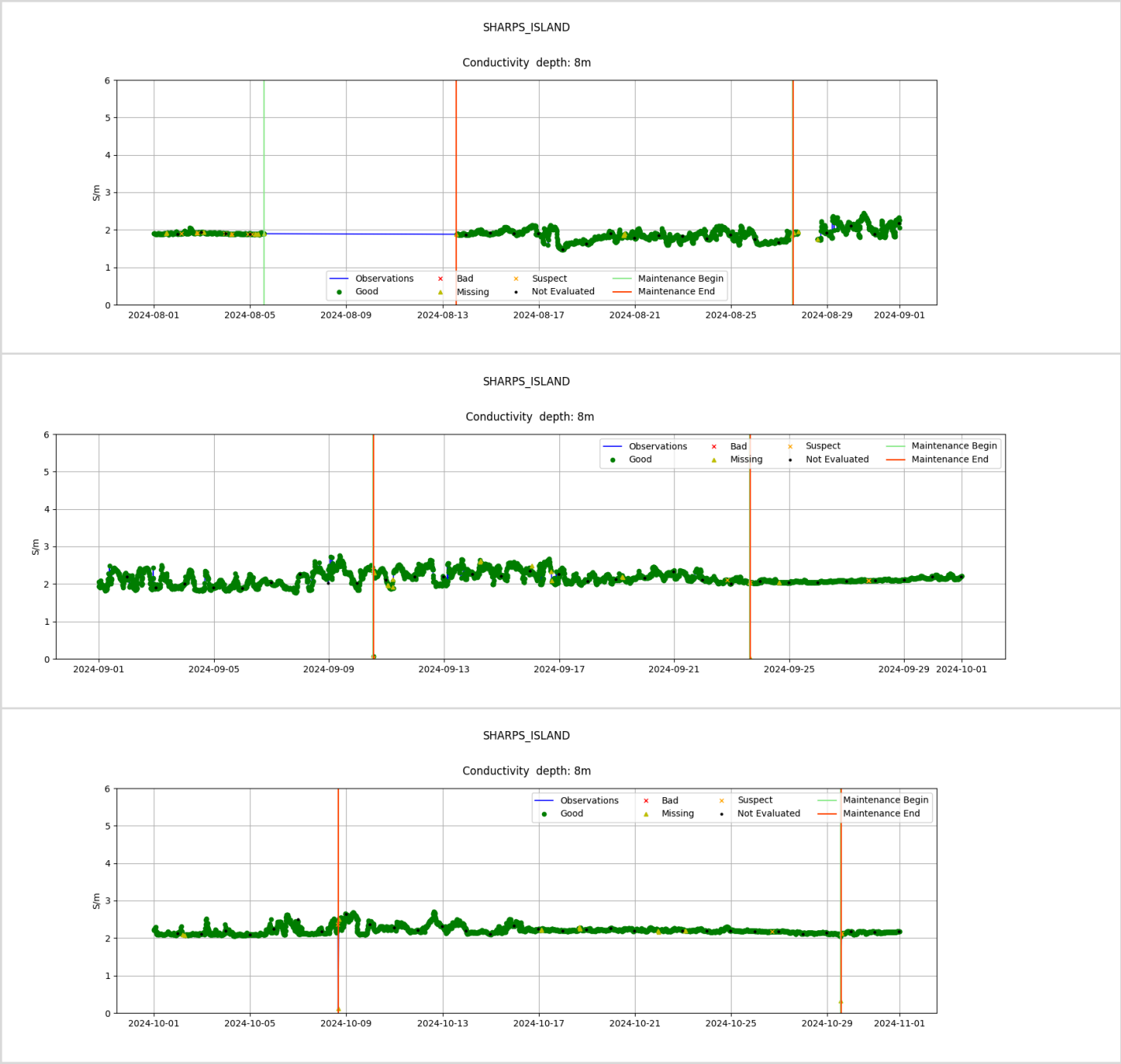


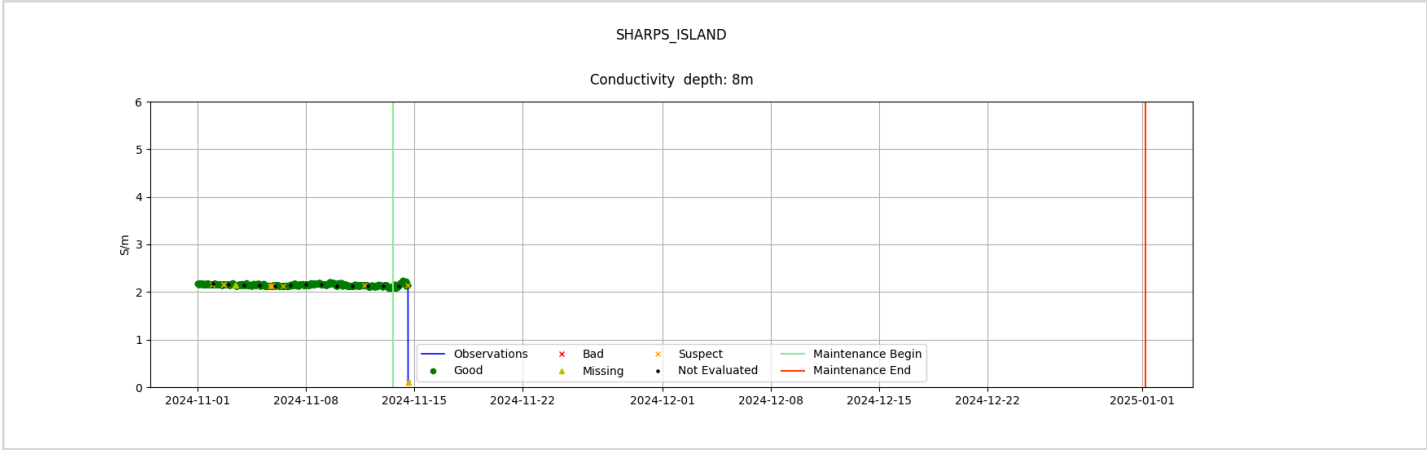




Sharps Island 8m Conductivity

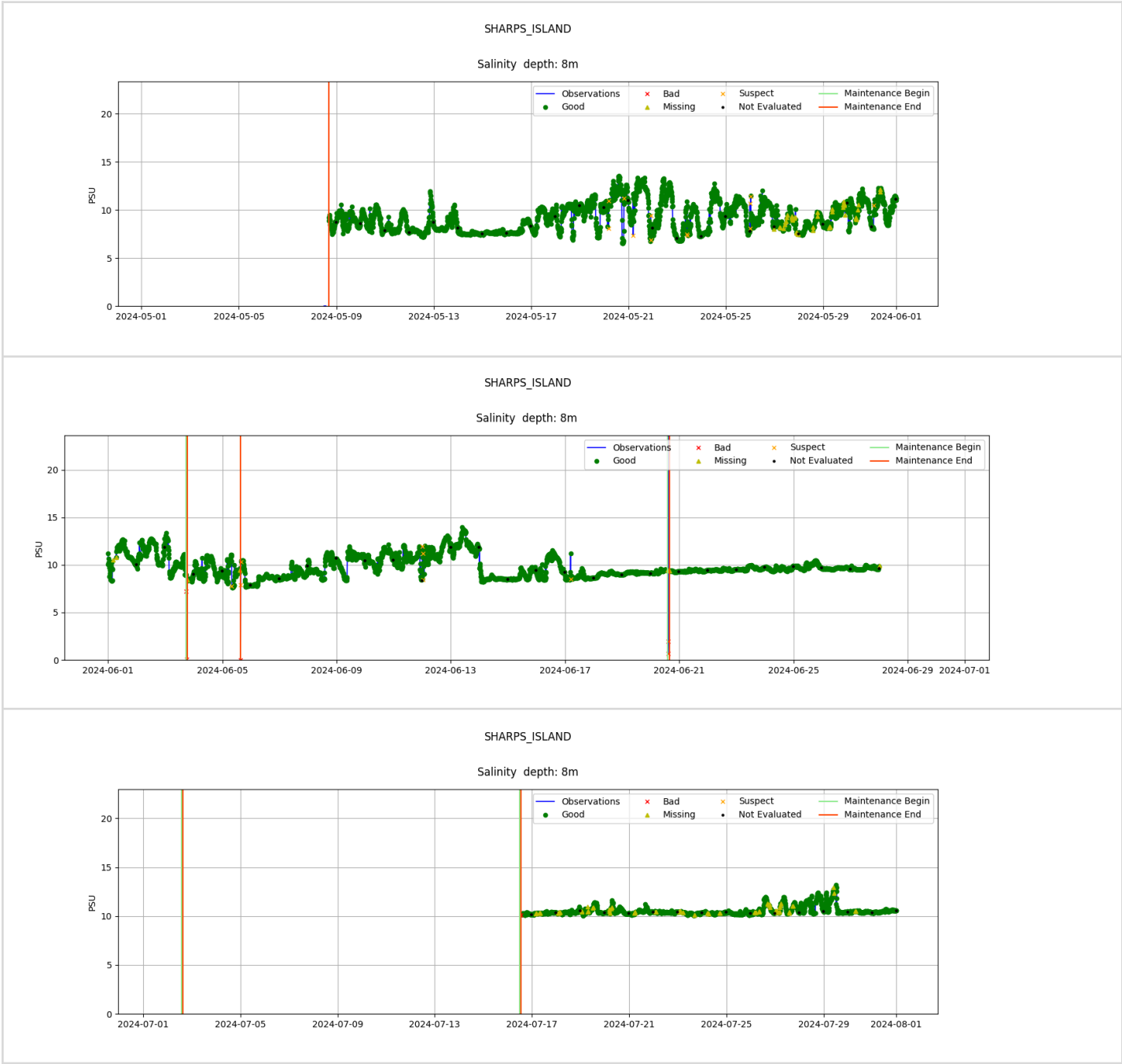


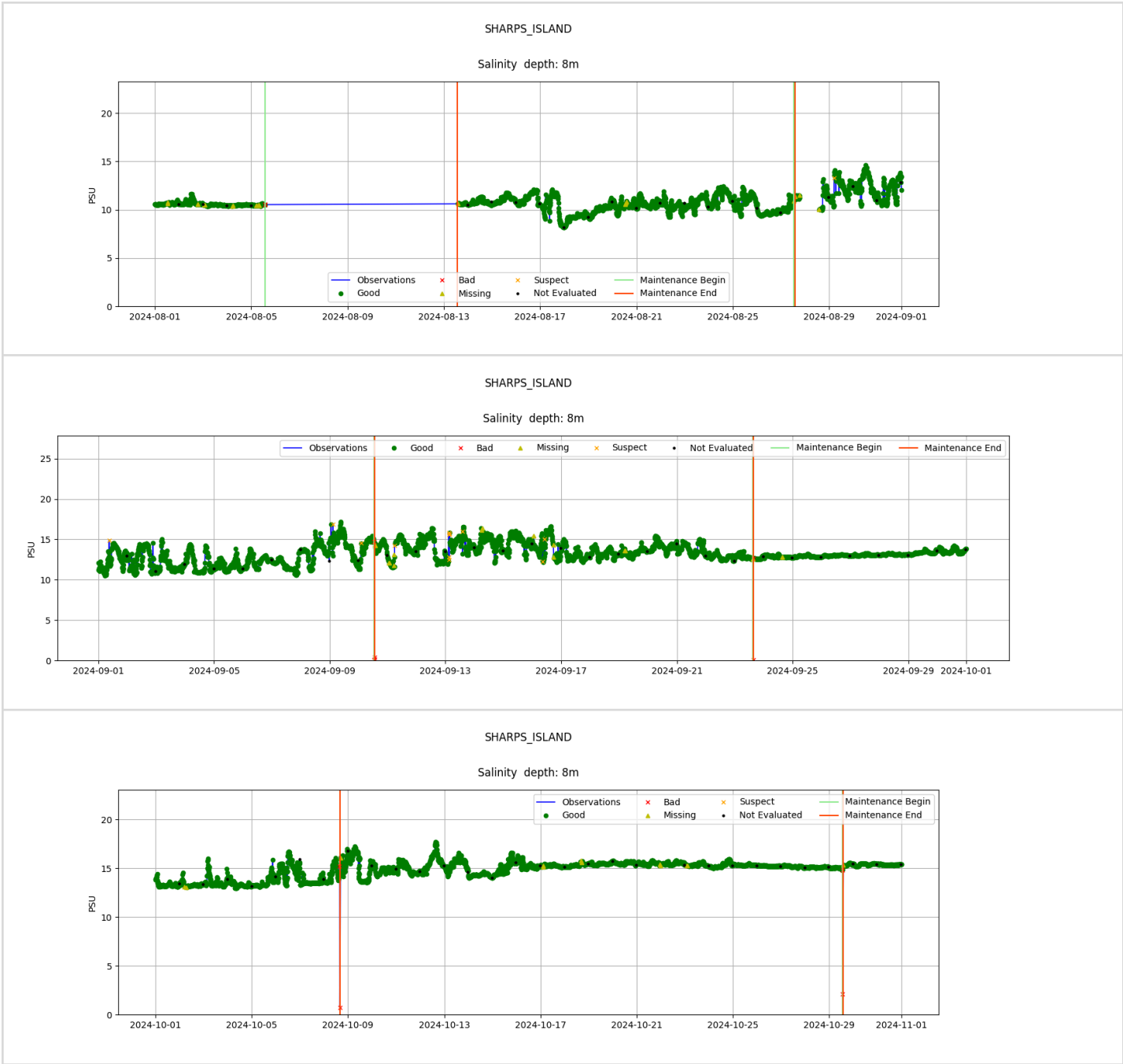


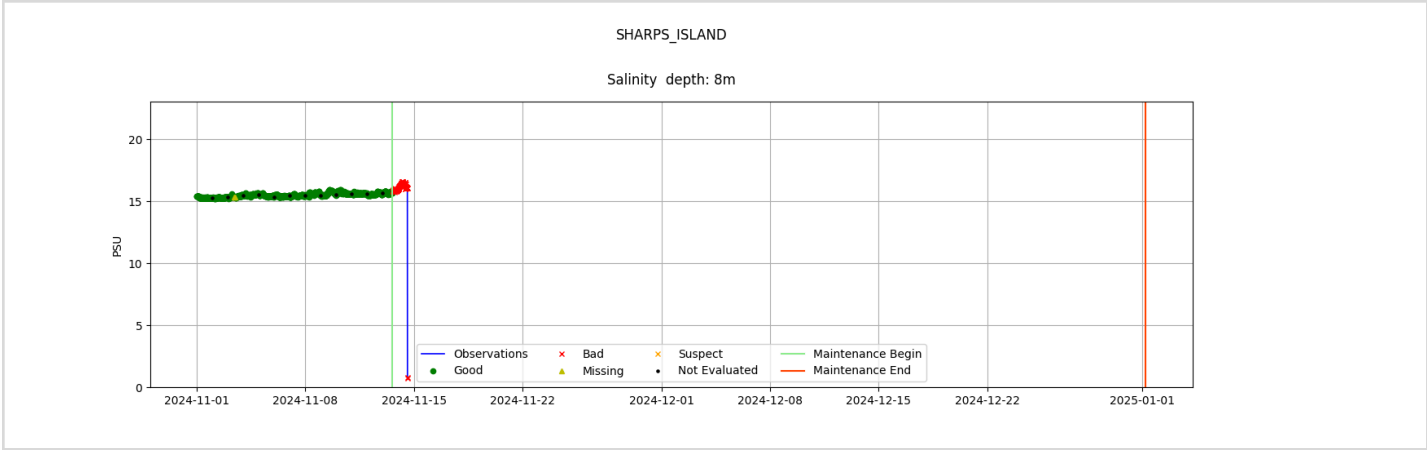




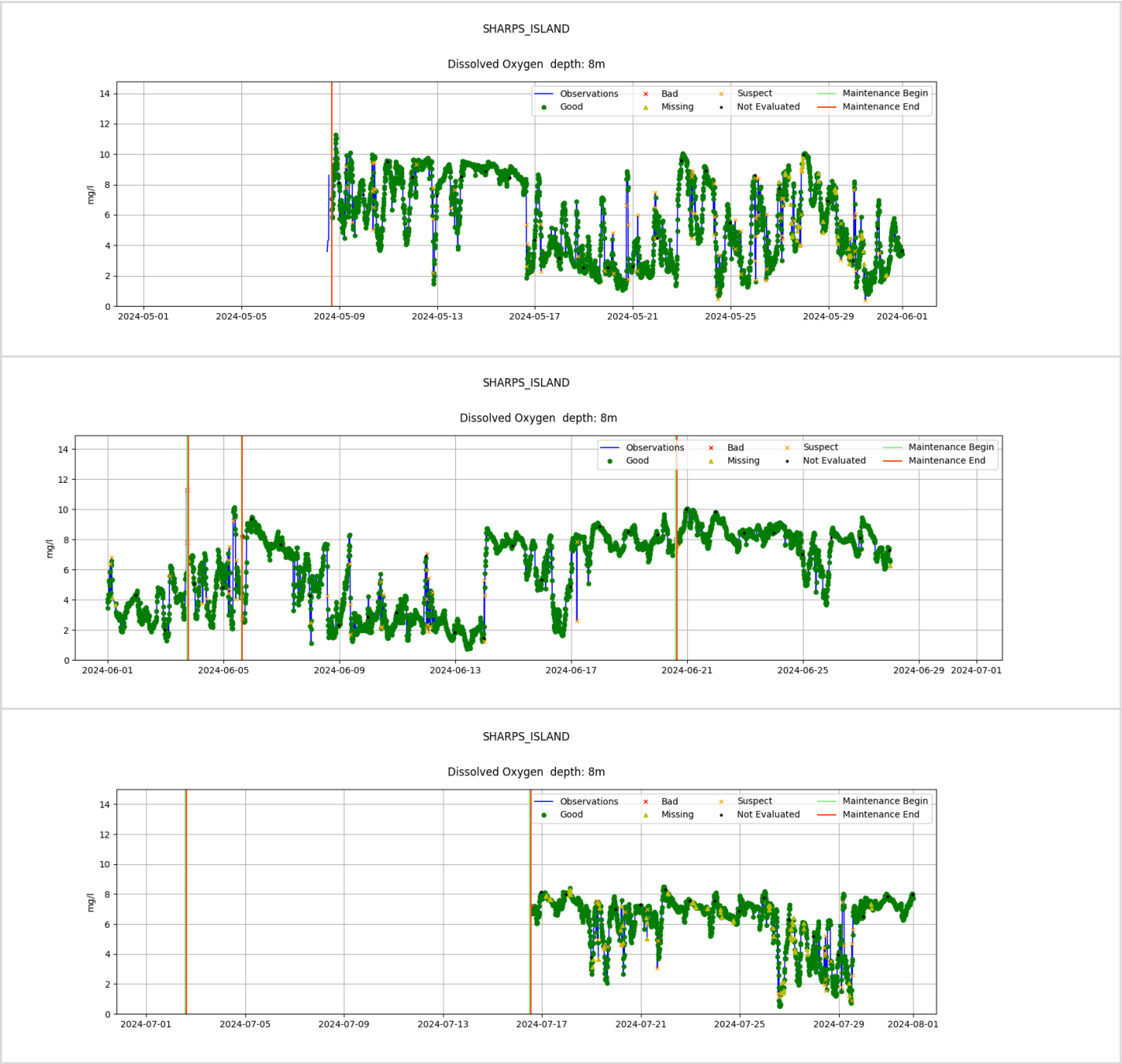
Sharps Island 8m Salinity

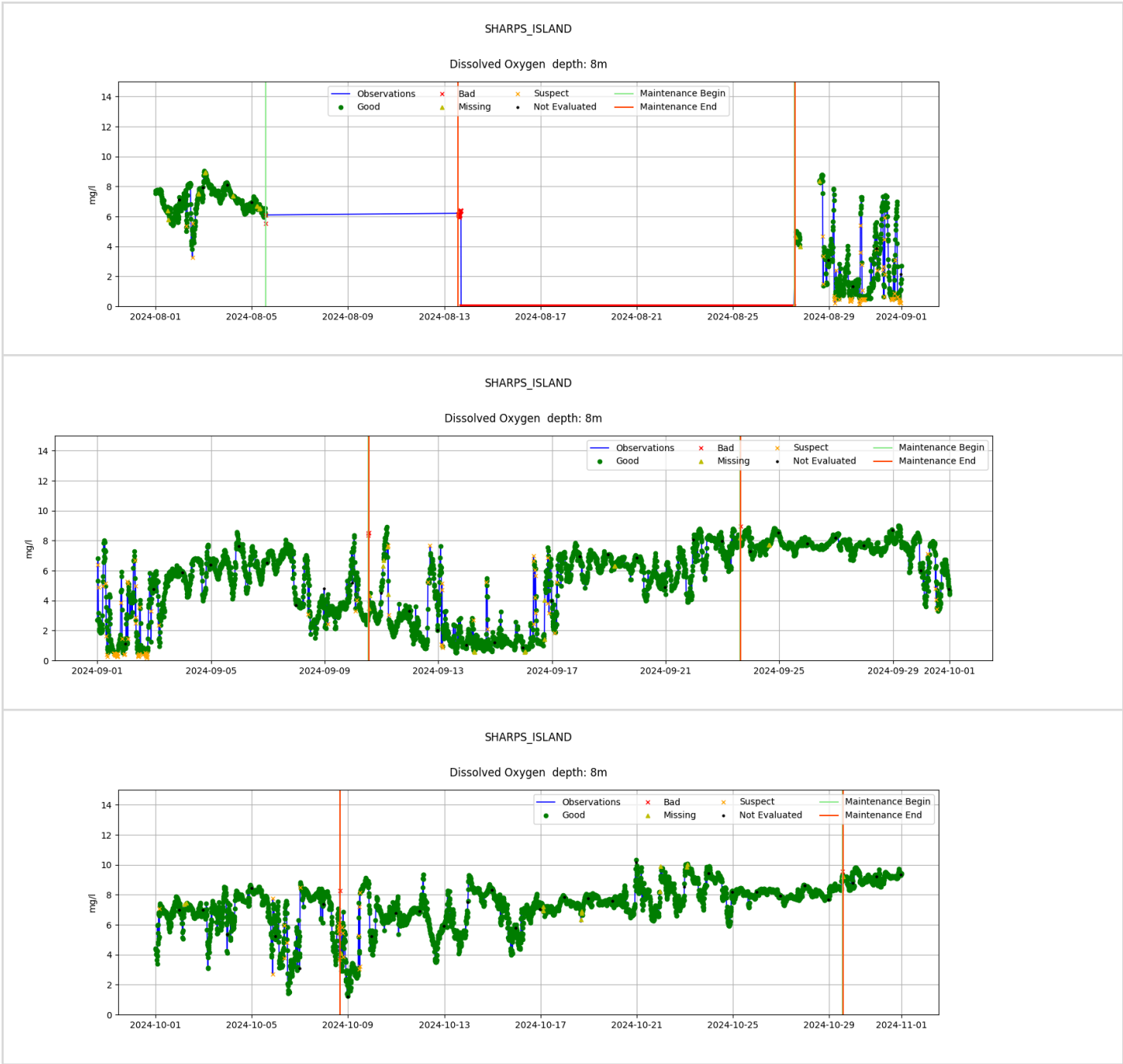


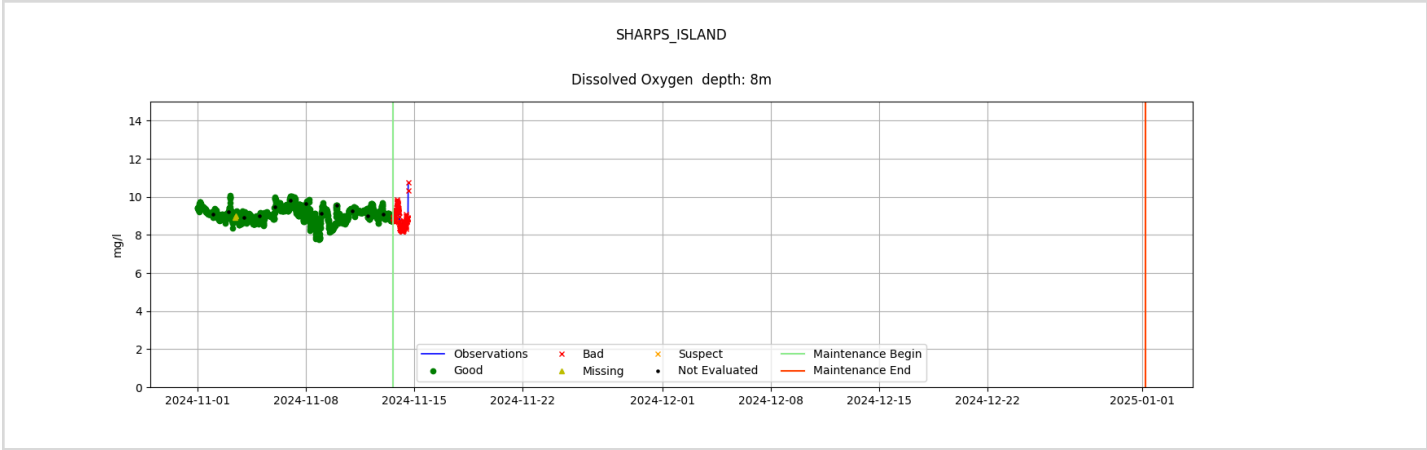




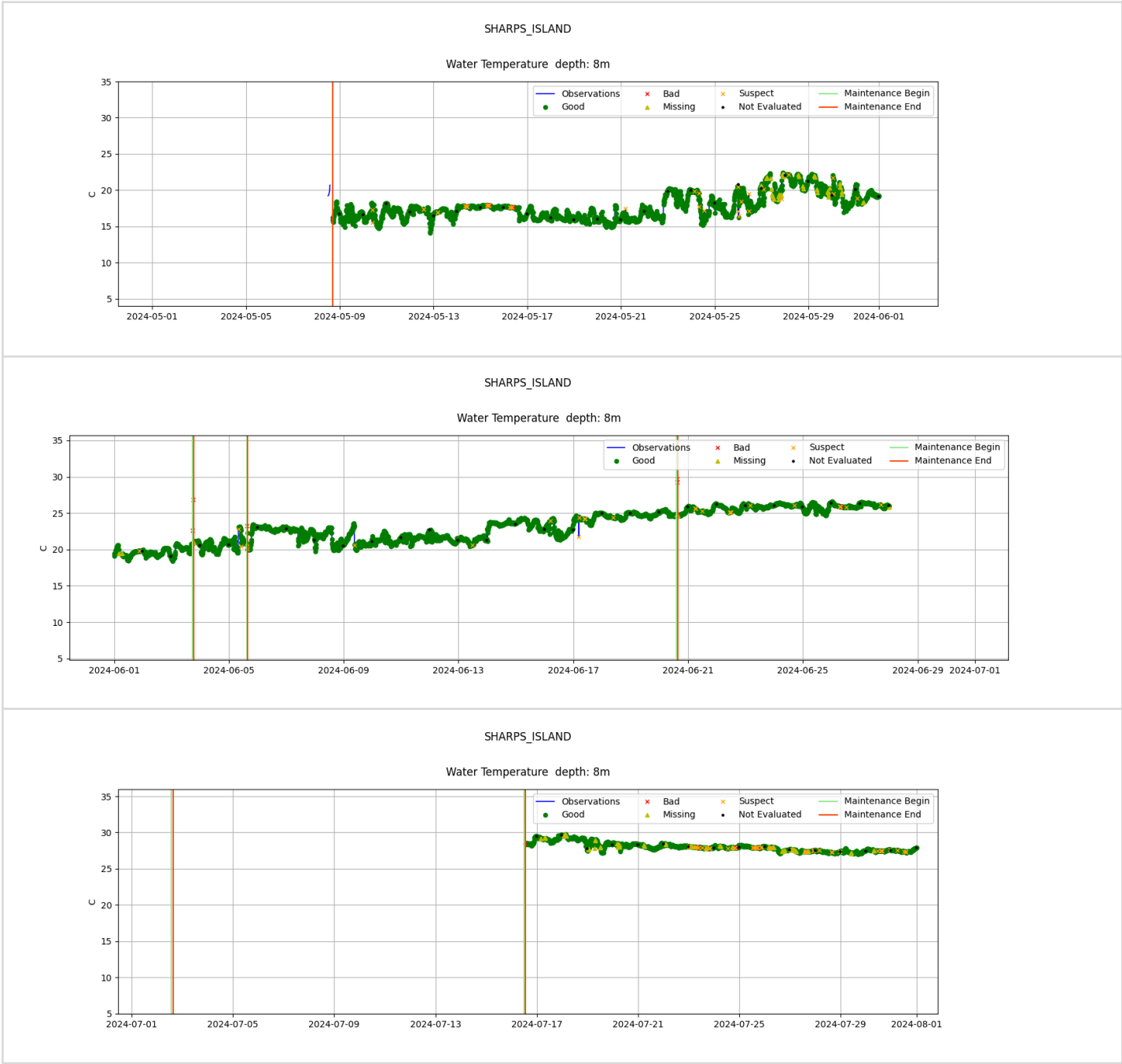
Sharps Island 8m Dissolved Oxygen

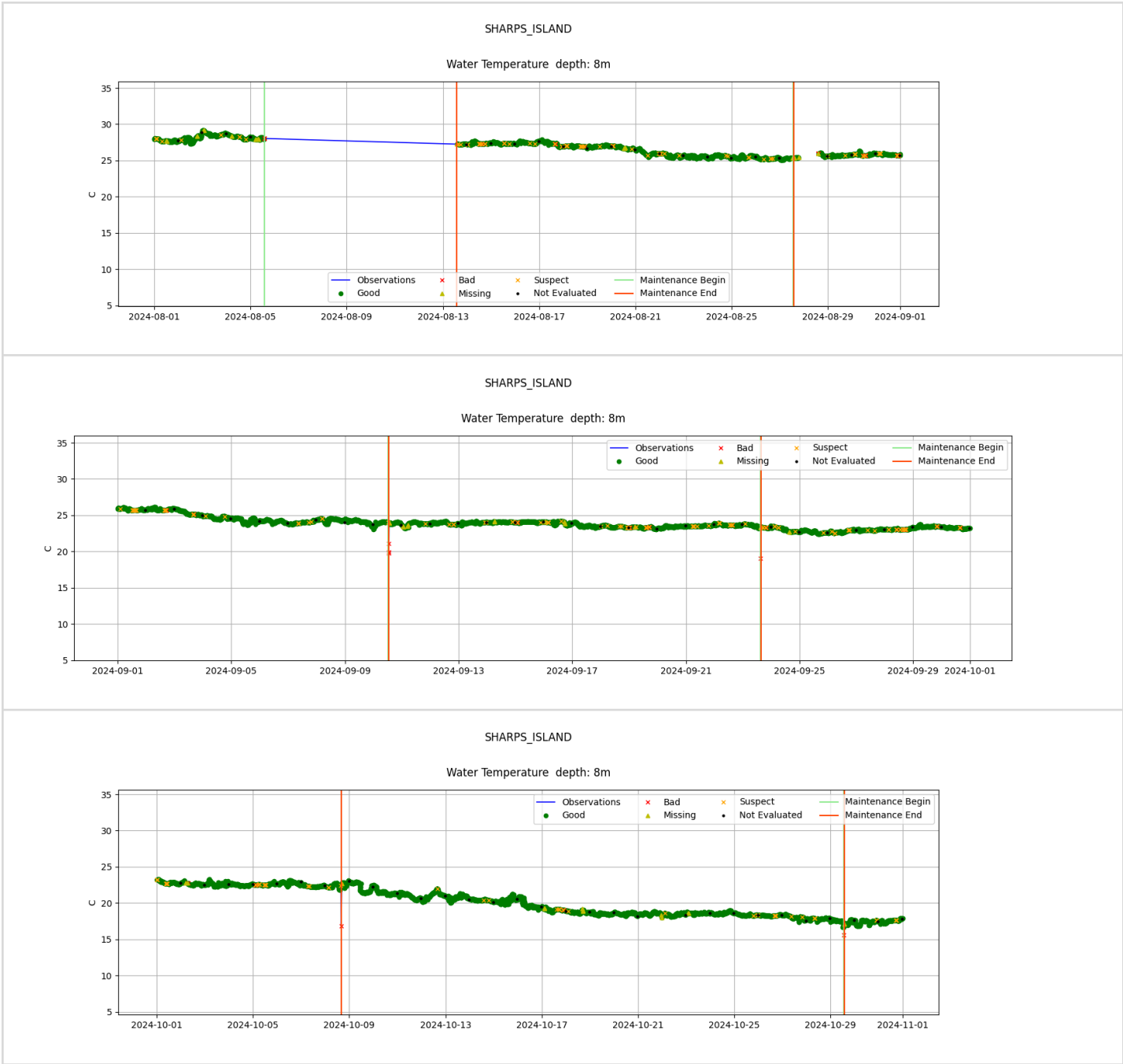




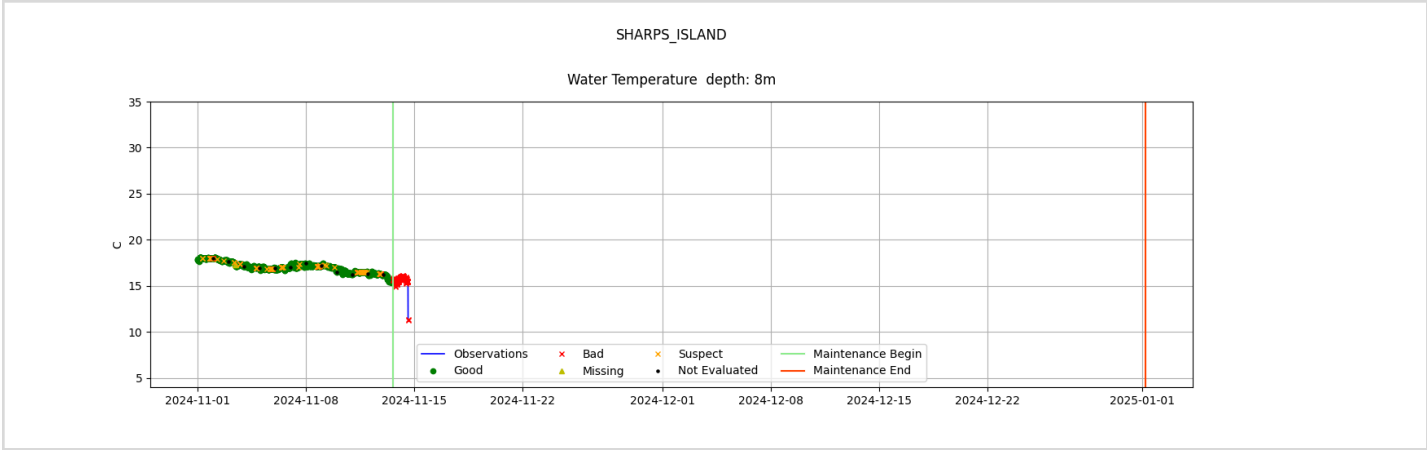


Sharps Island 8m Water Temperature

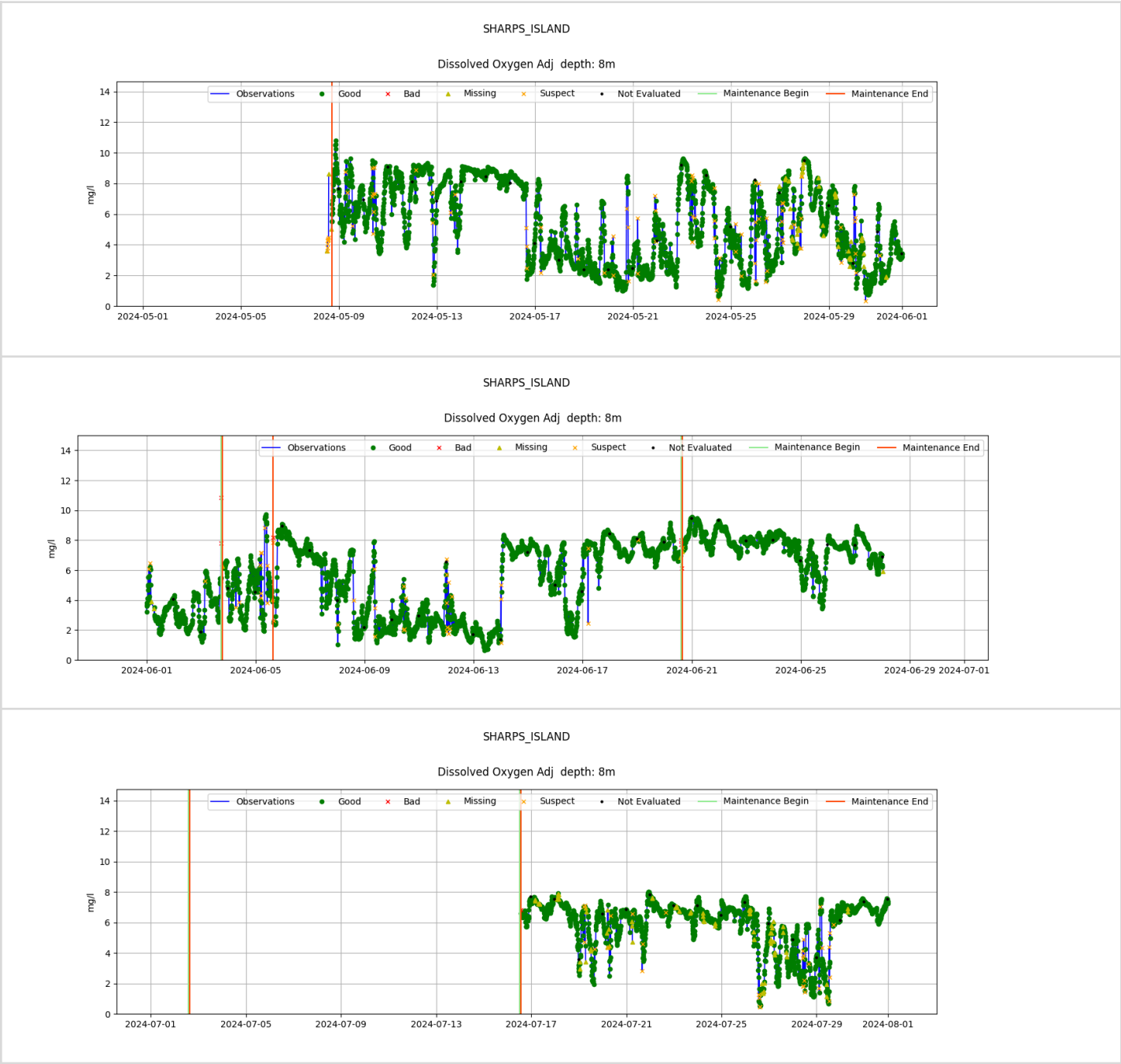


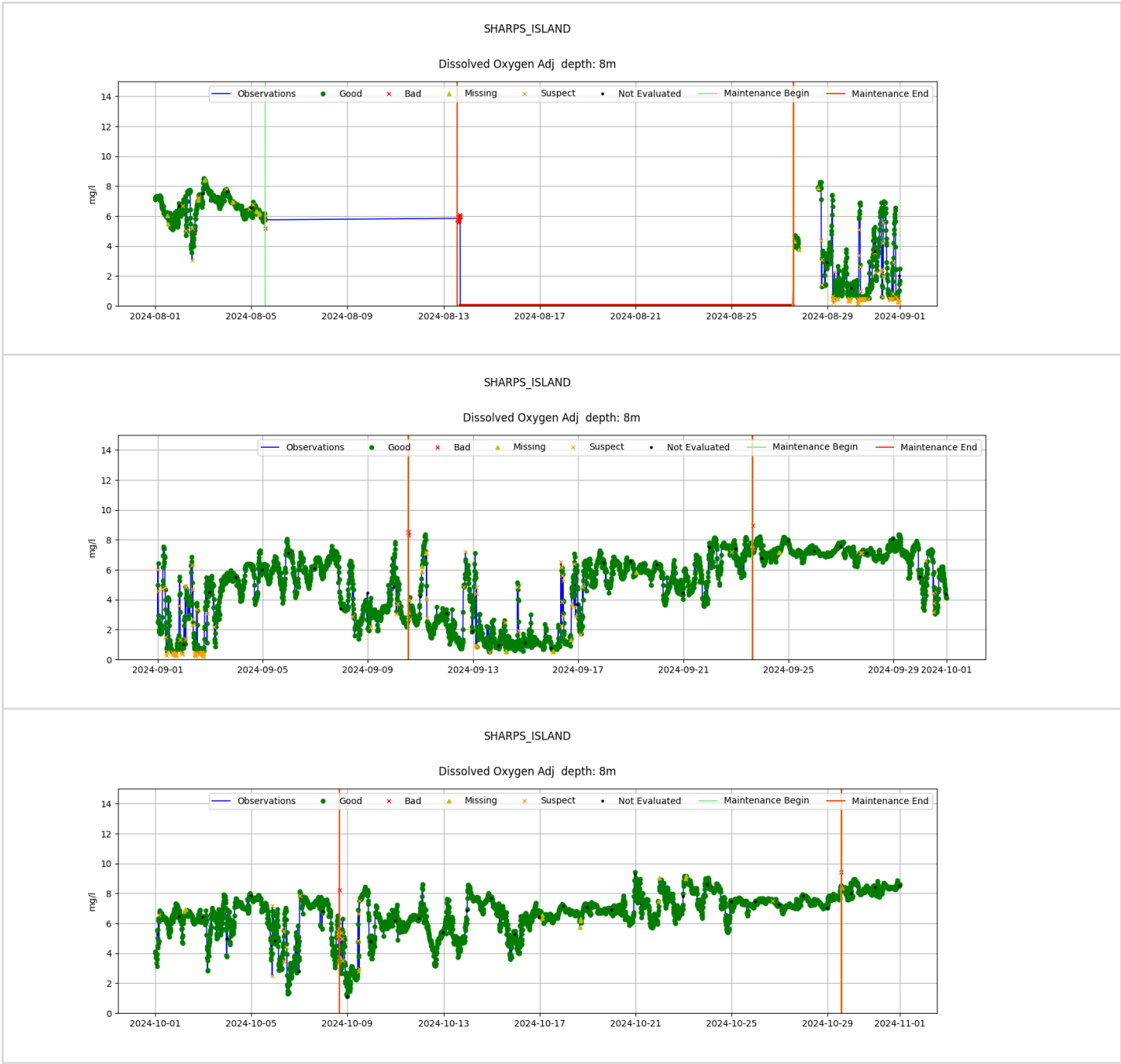


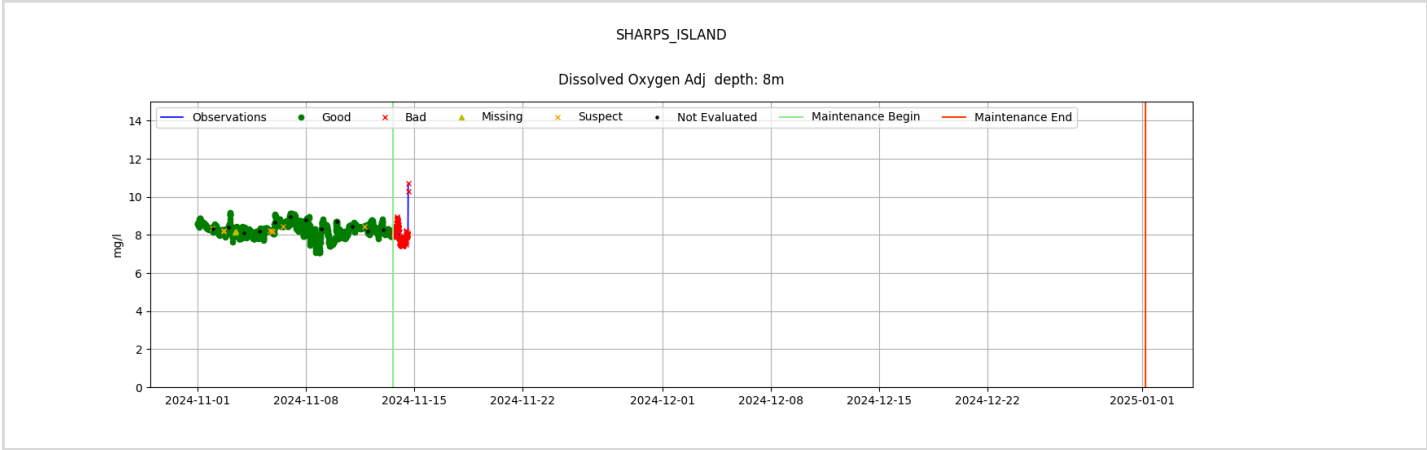




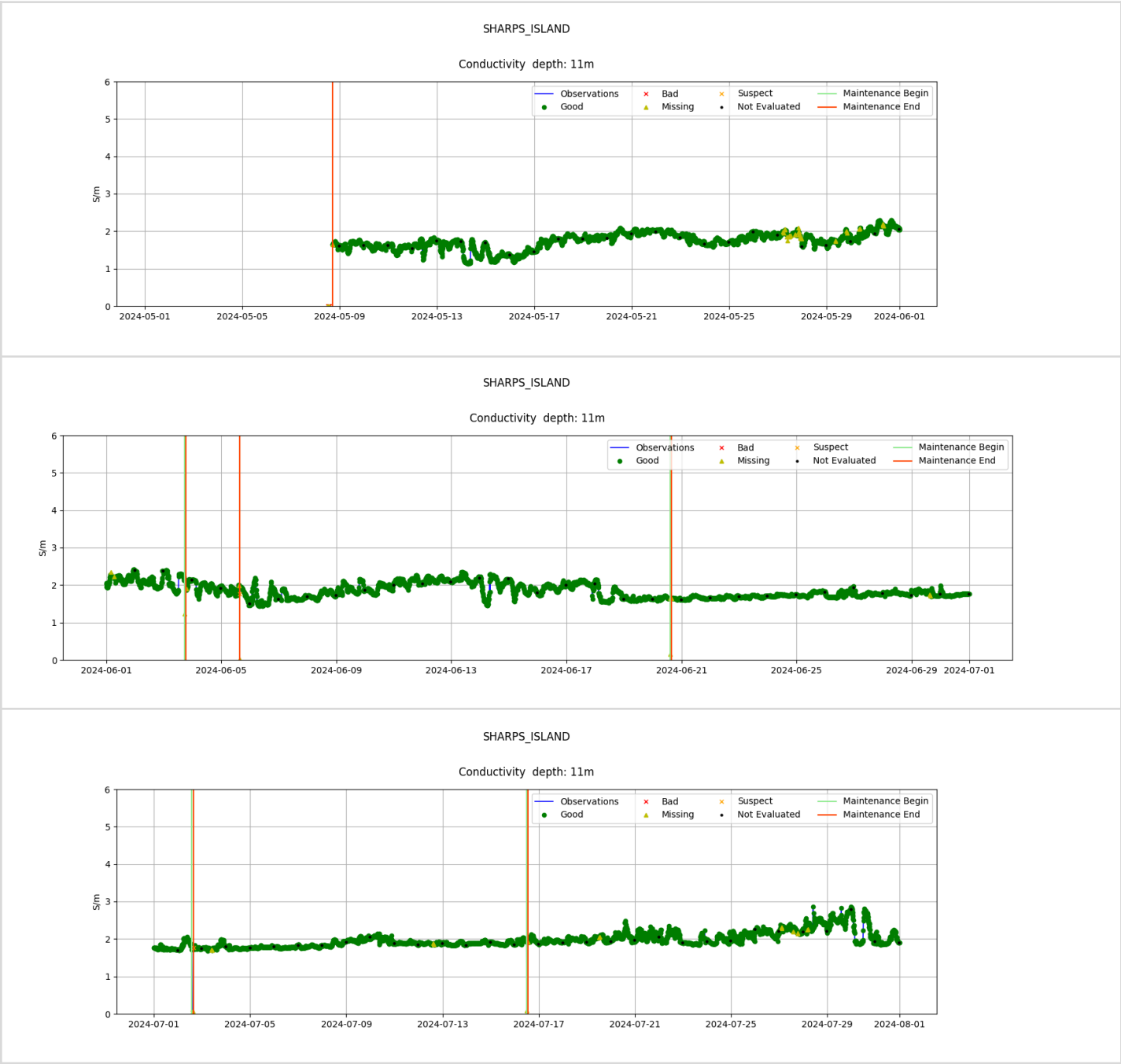
Sharps Island 8m Dissolved Oxygen Adjusted

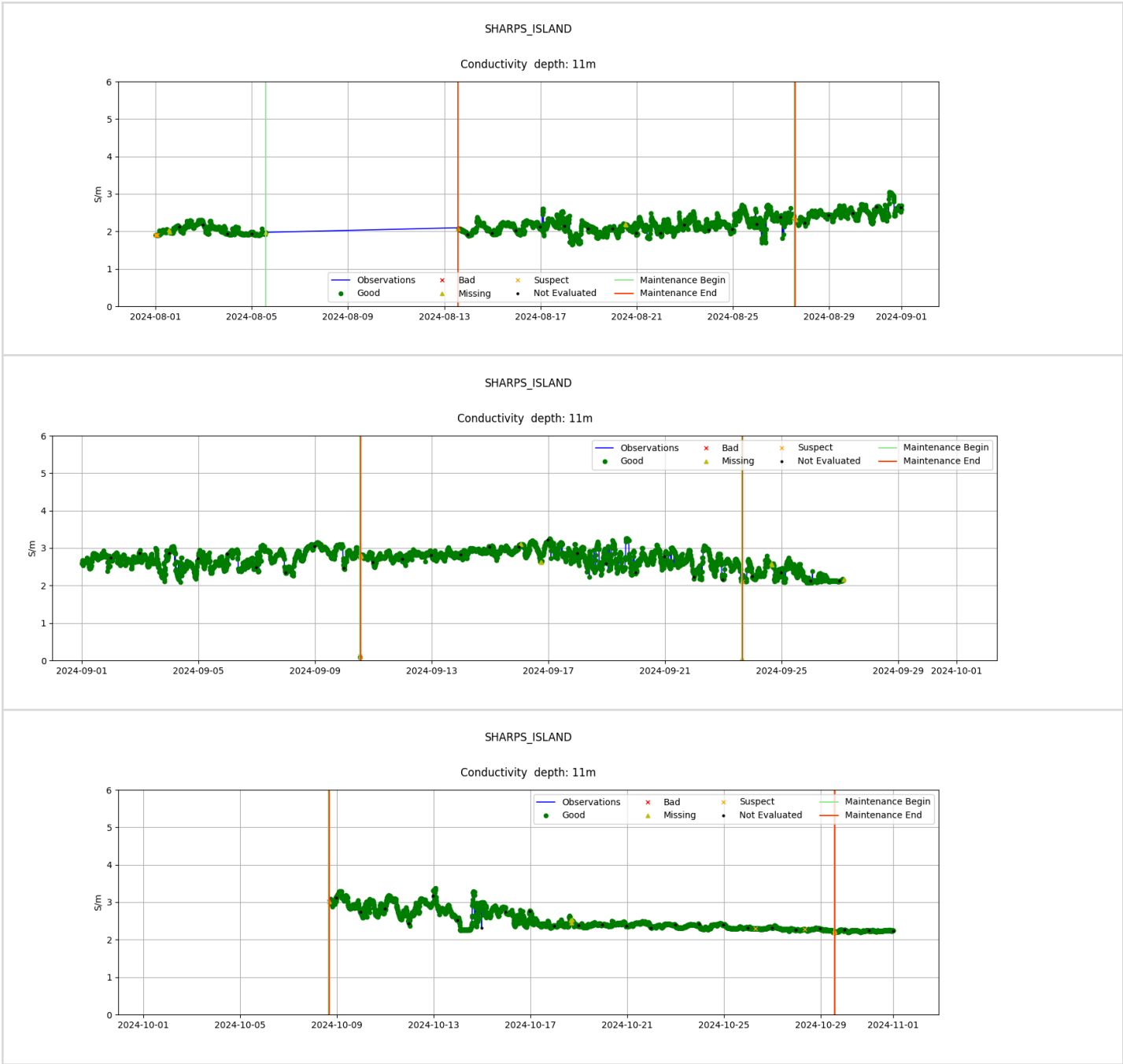


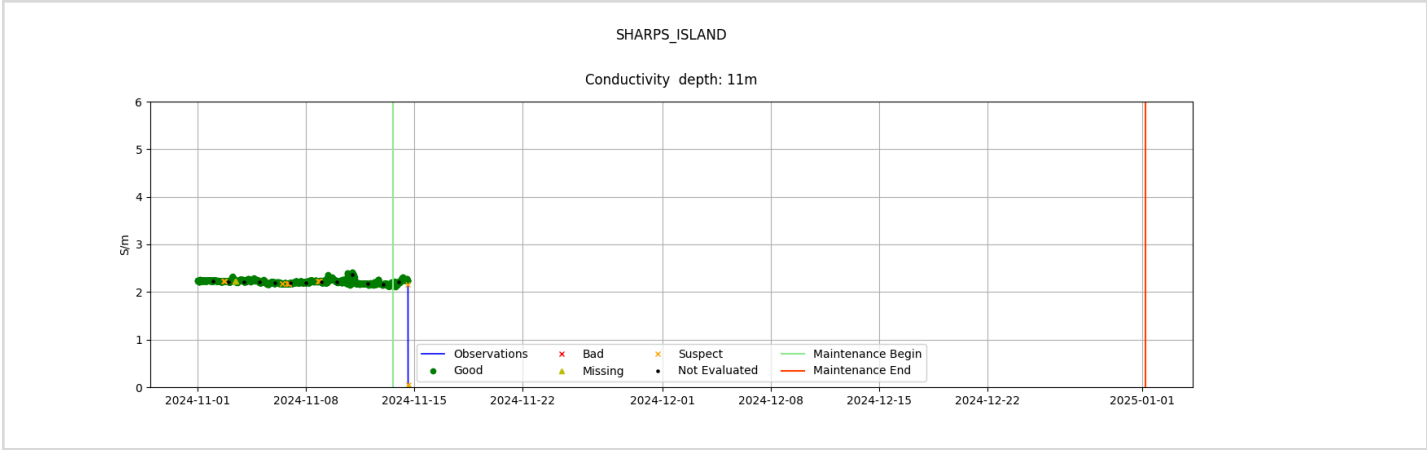




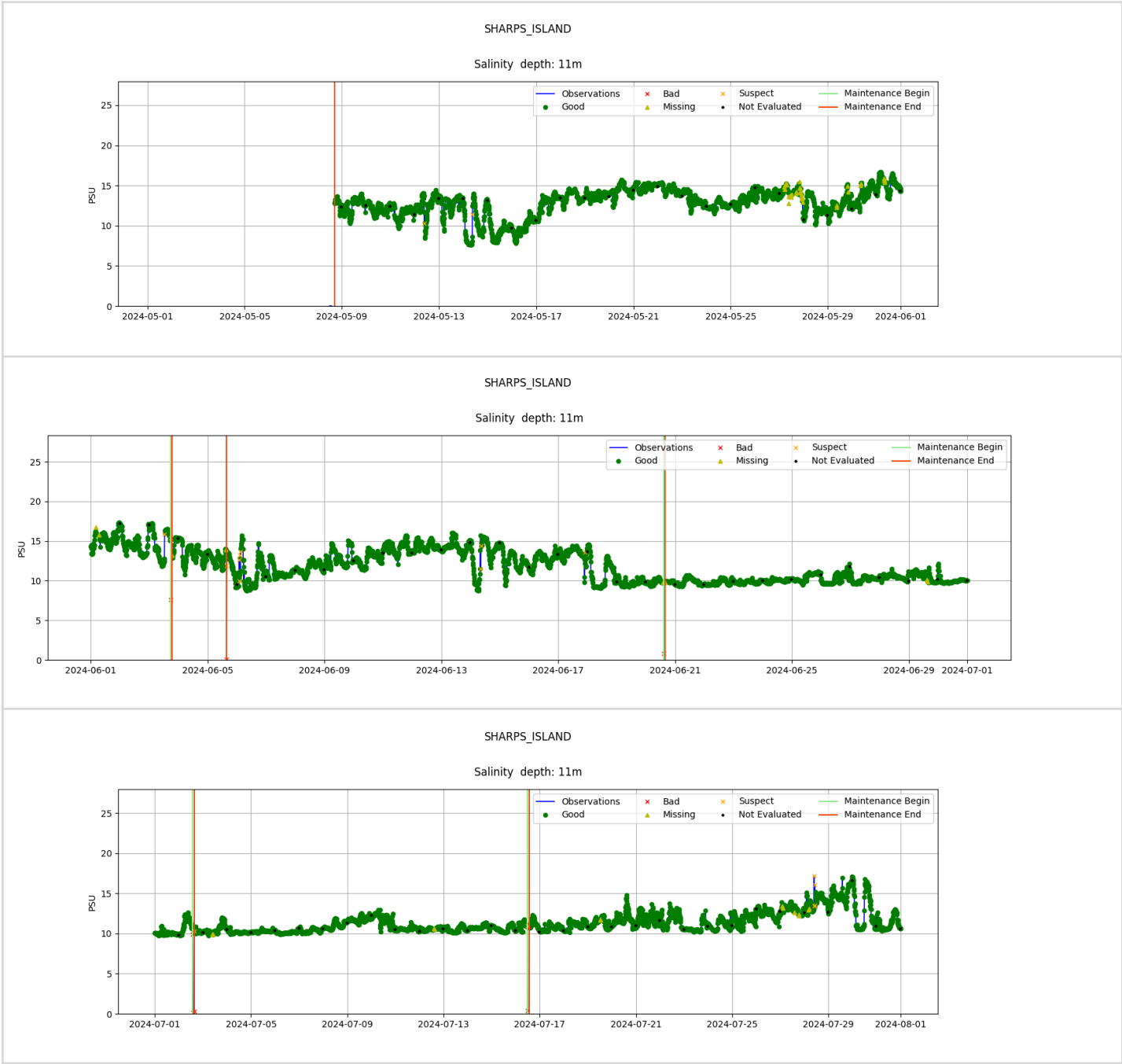
Sharps Island 11m Conductivity



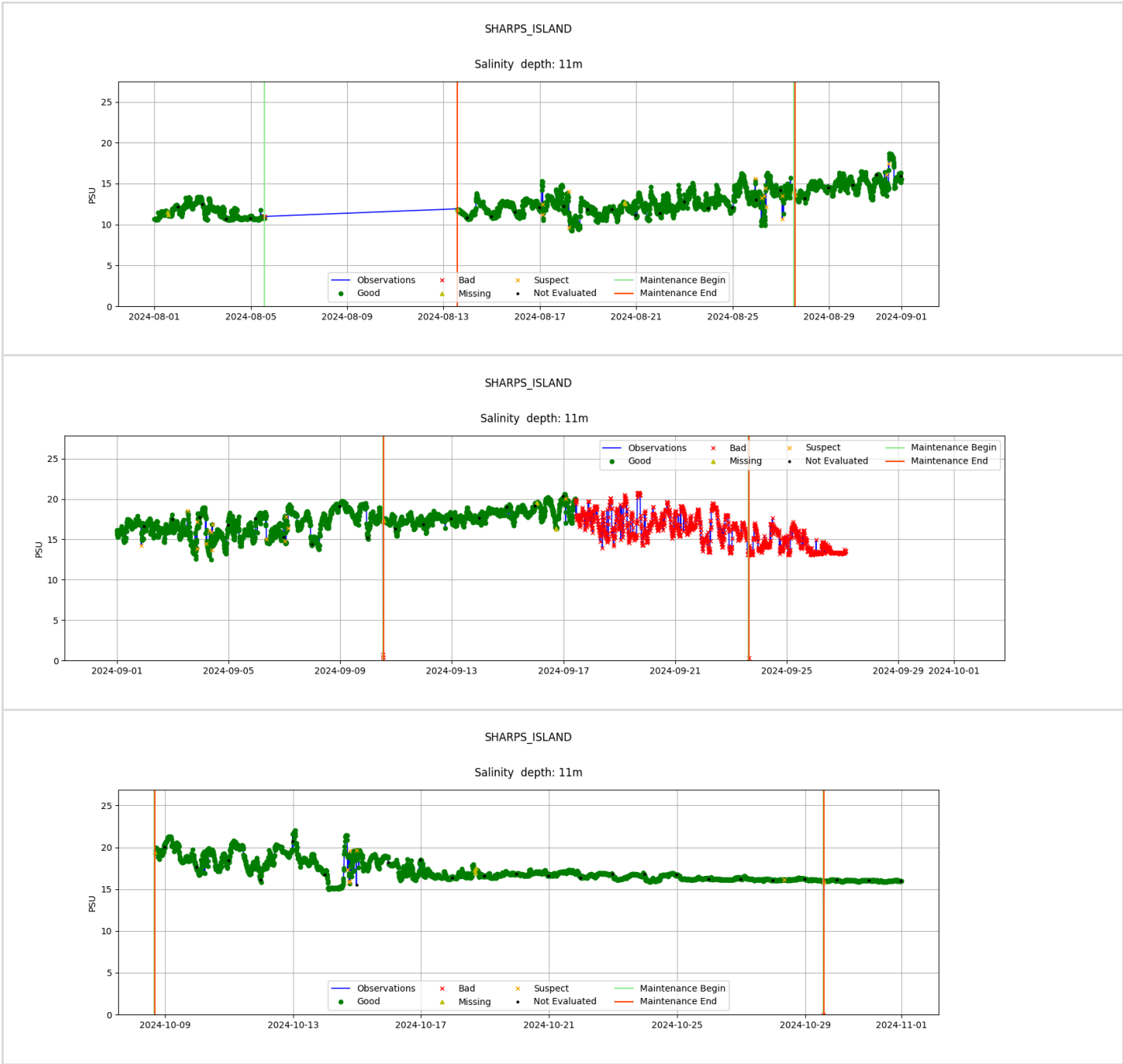


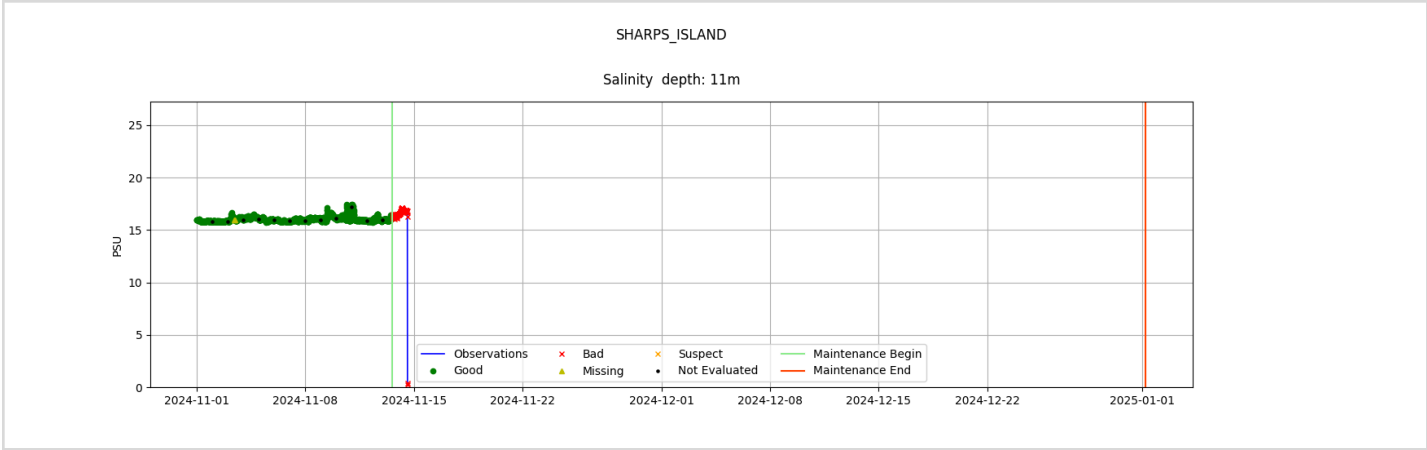


Sharps Island 11m Salinity



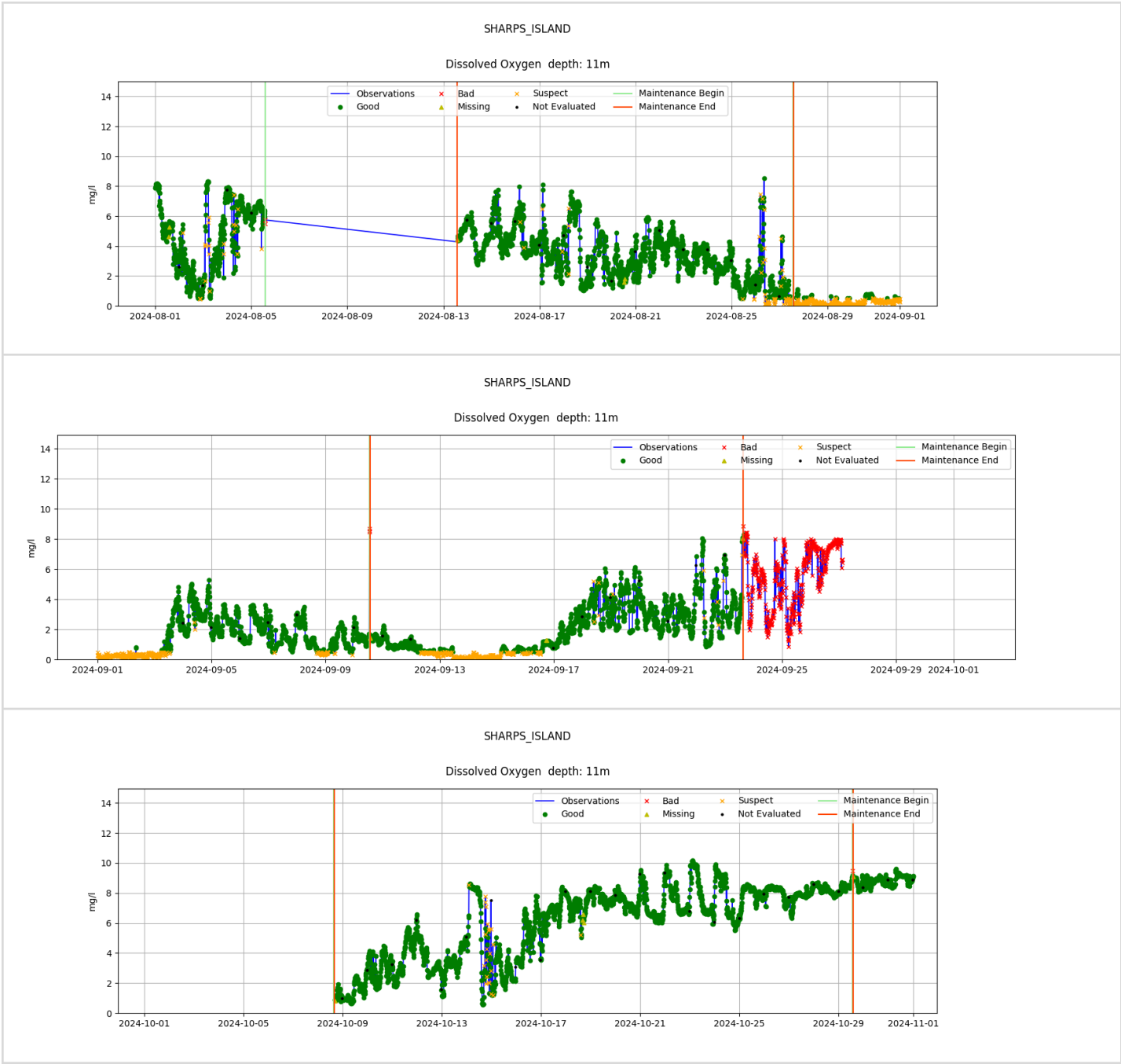


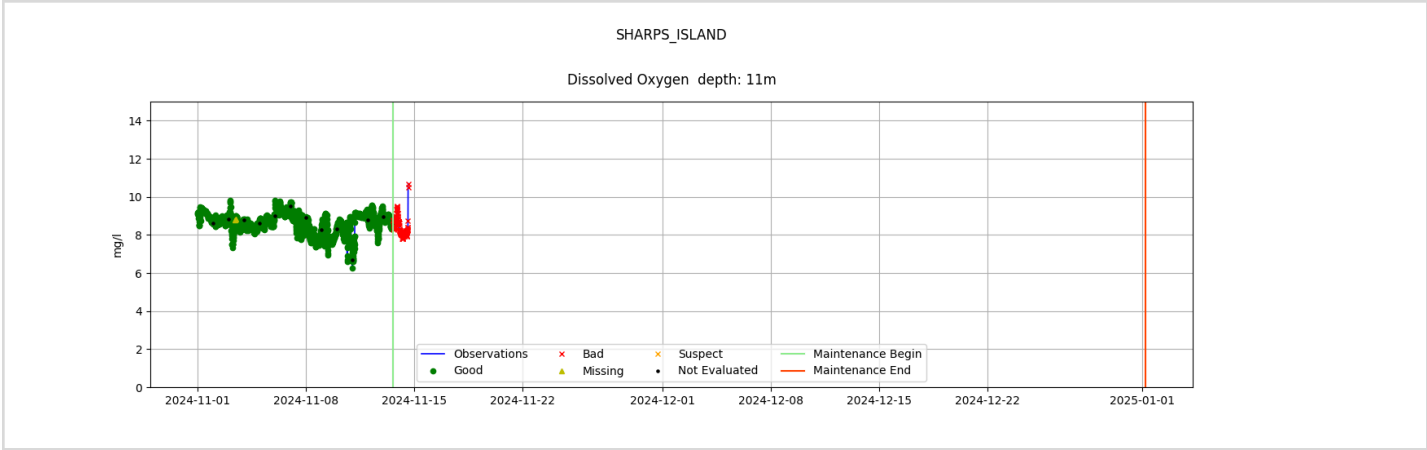




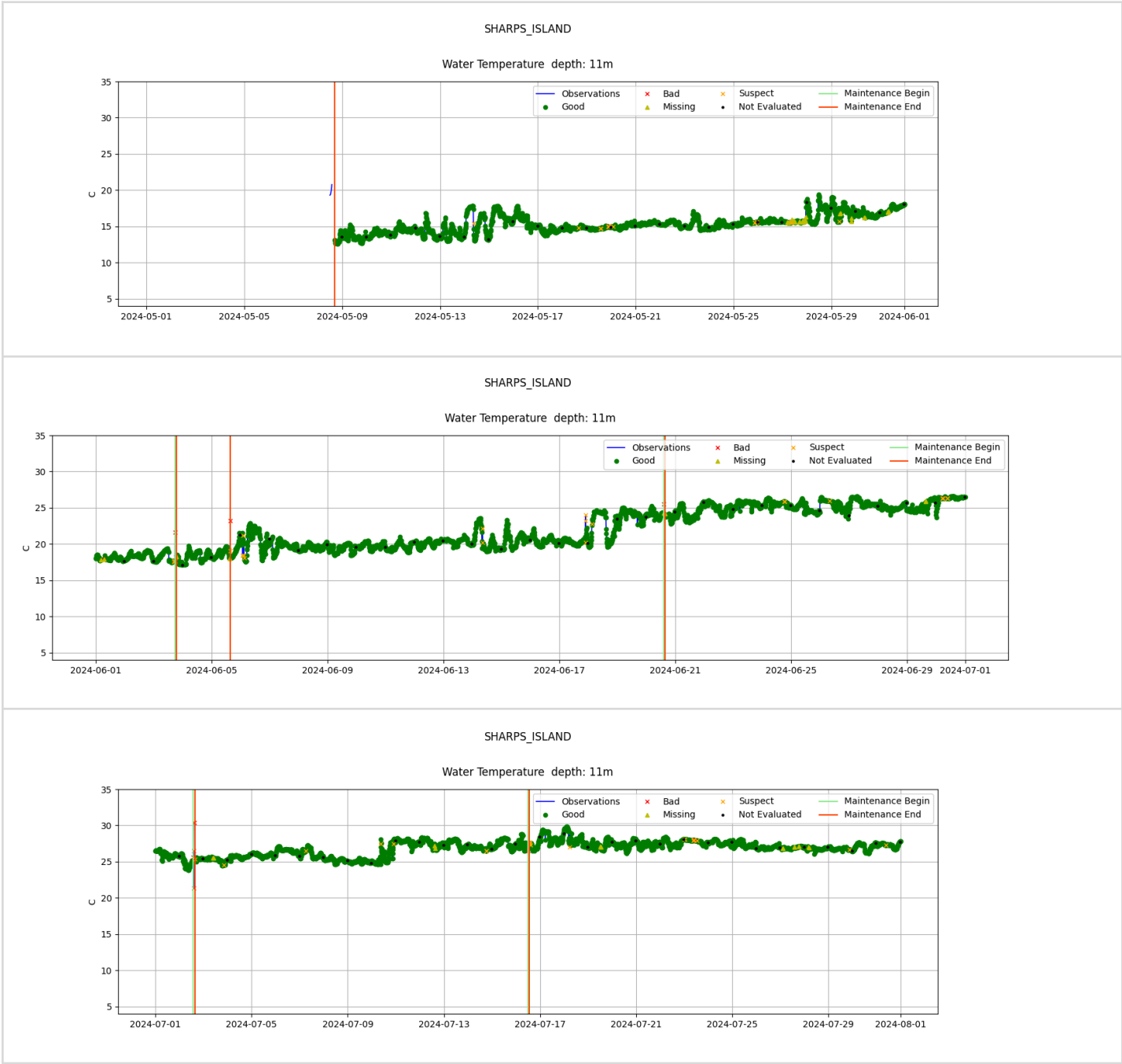
Sharps Island 11m Dissolved Oxygen



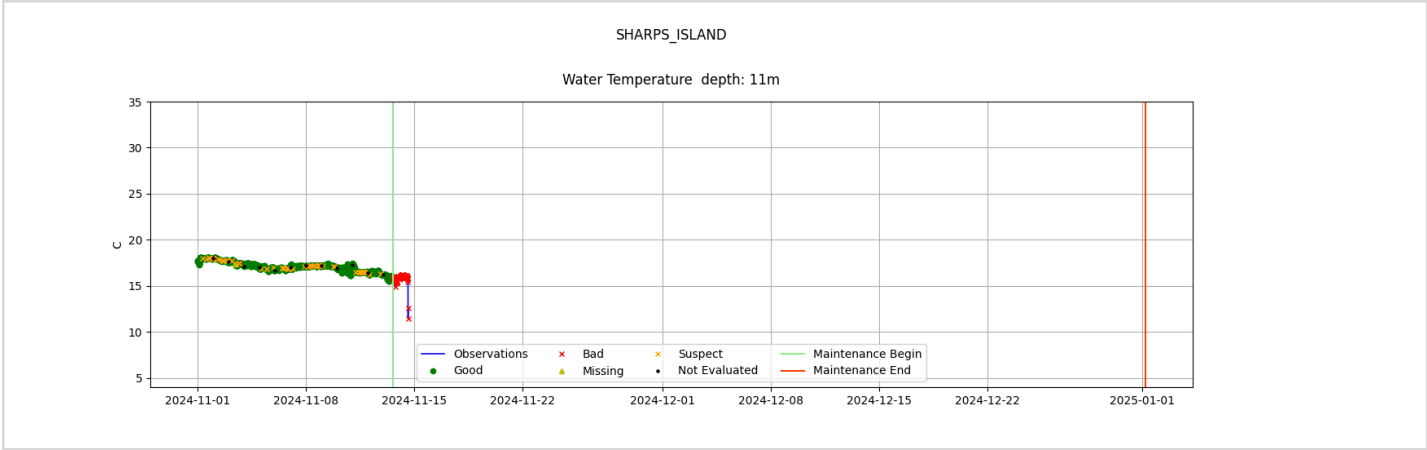




Sharps Island 11m Water Temperature



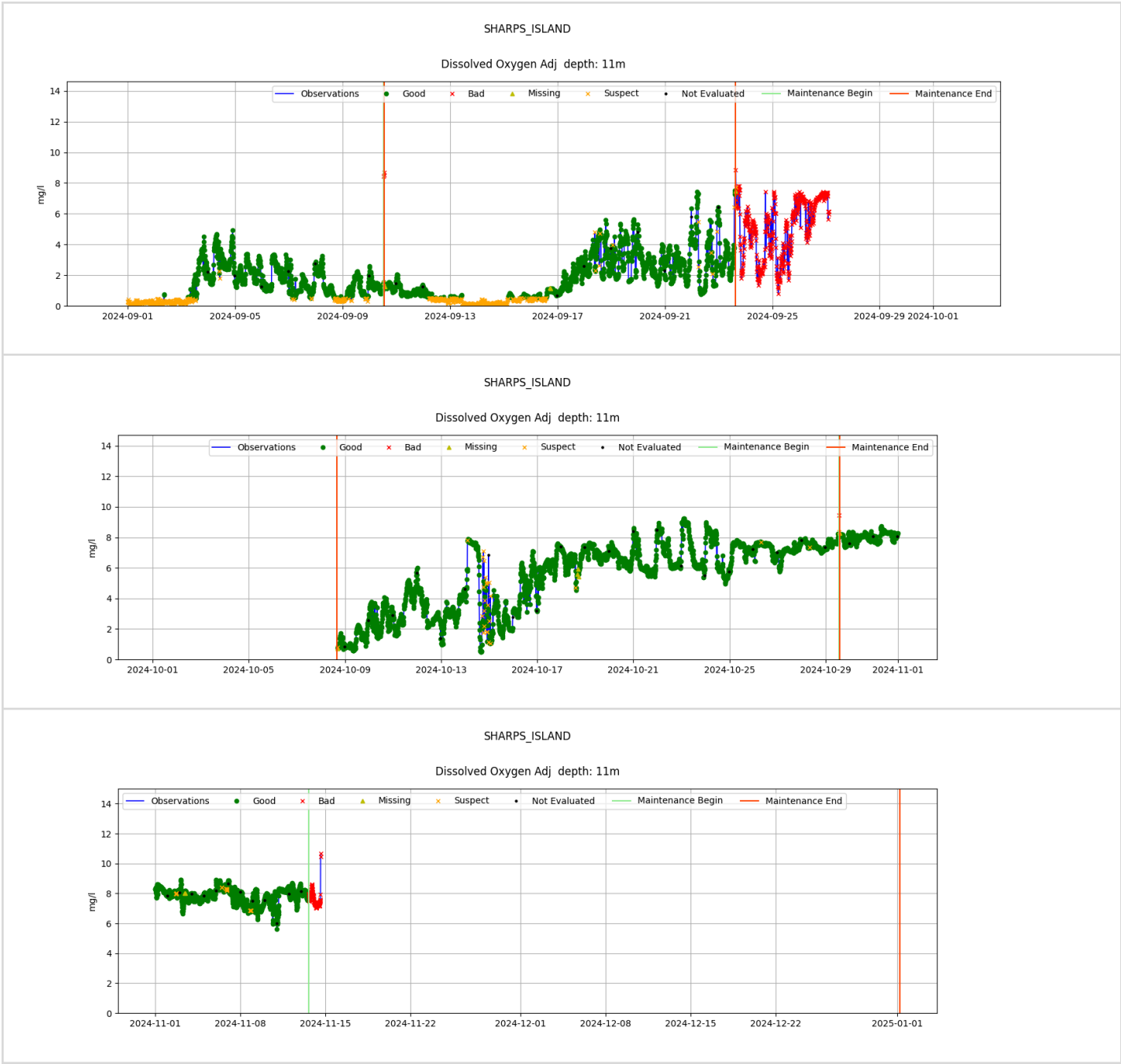




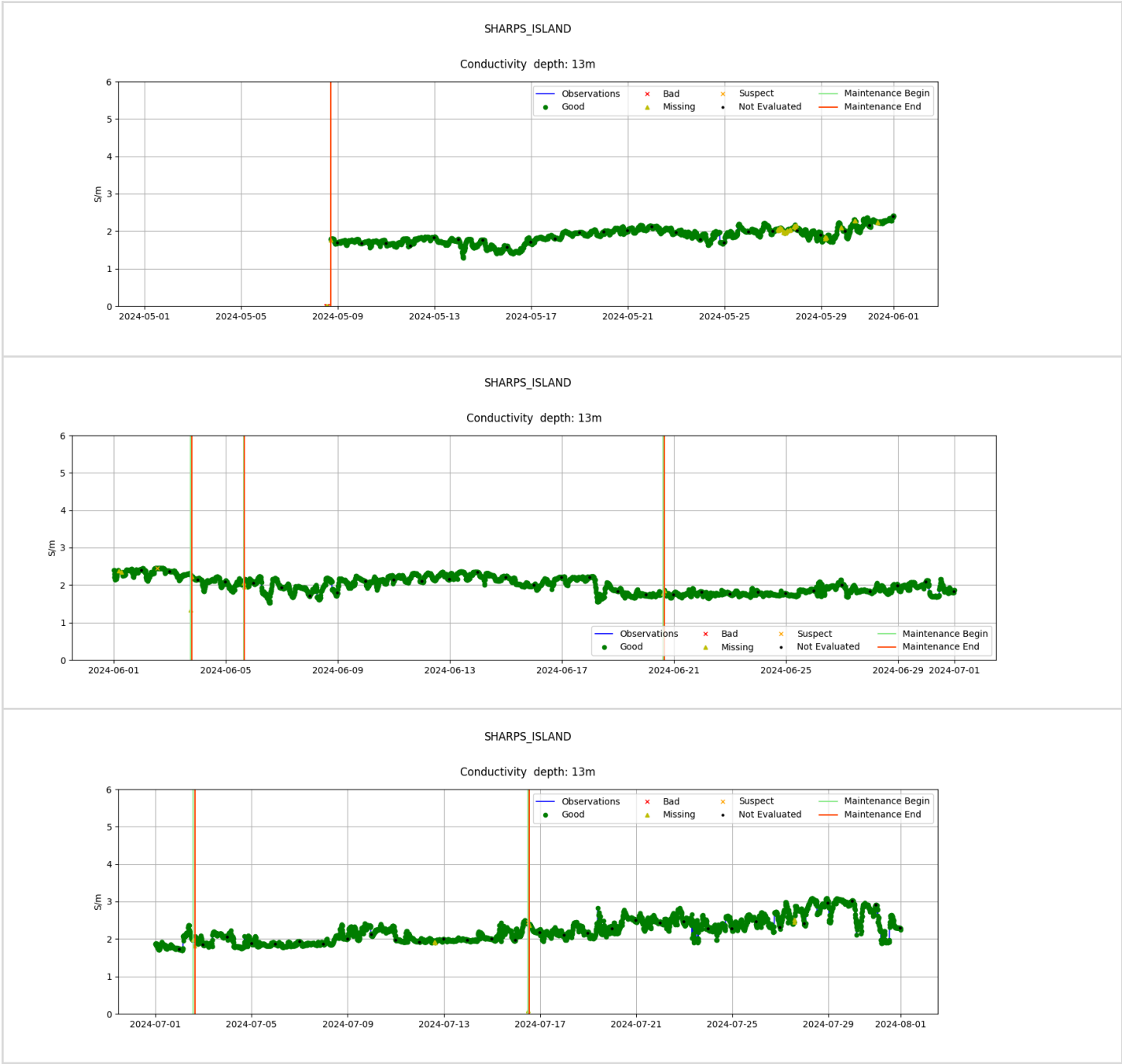


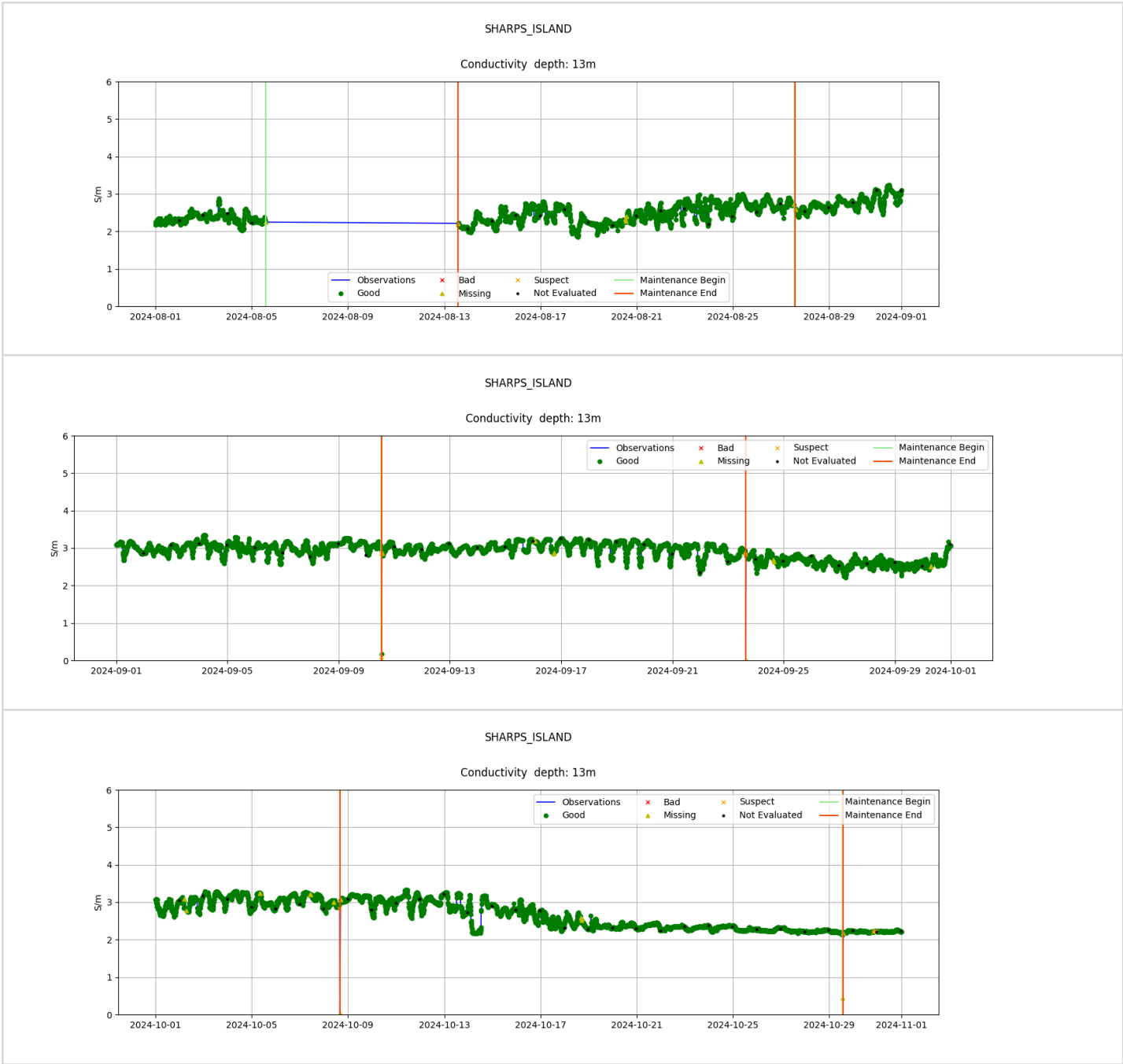
Sharps Island 11m Dissolved Oxygen Adjusted

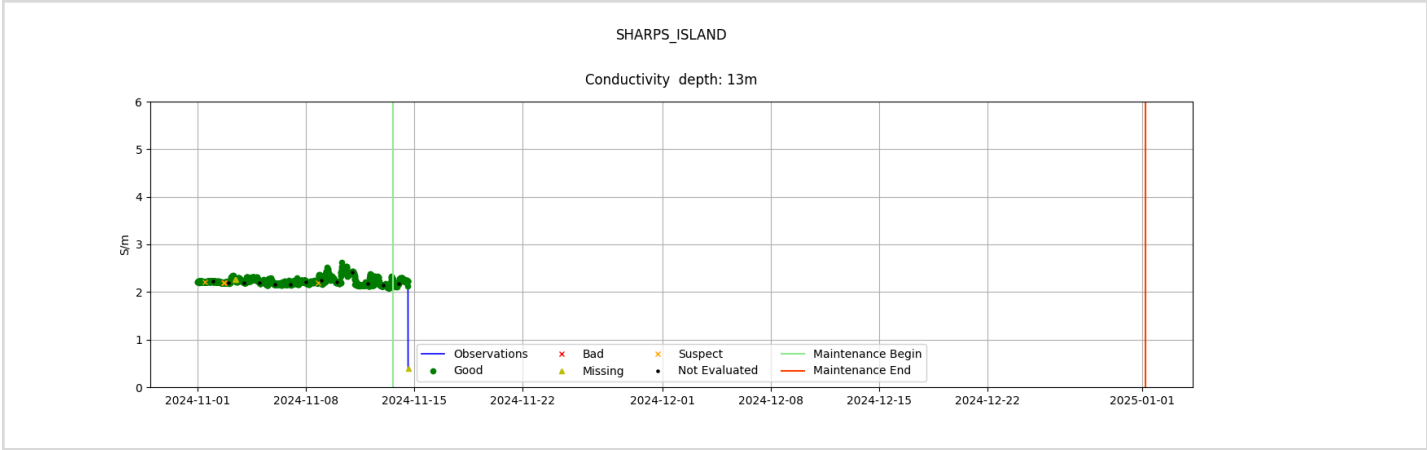




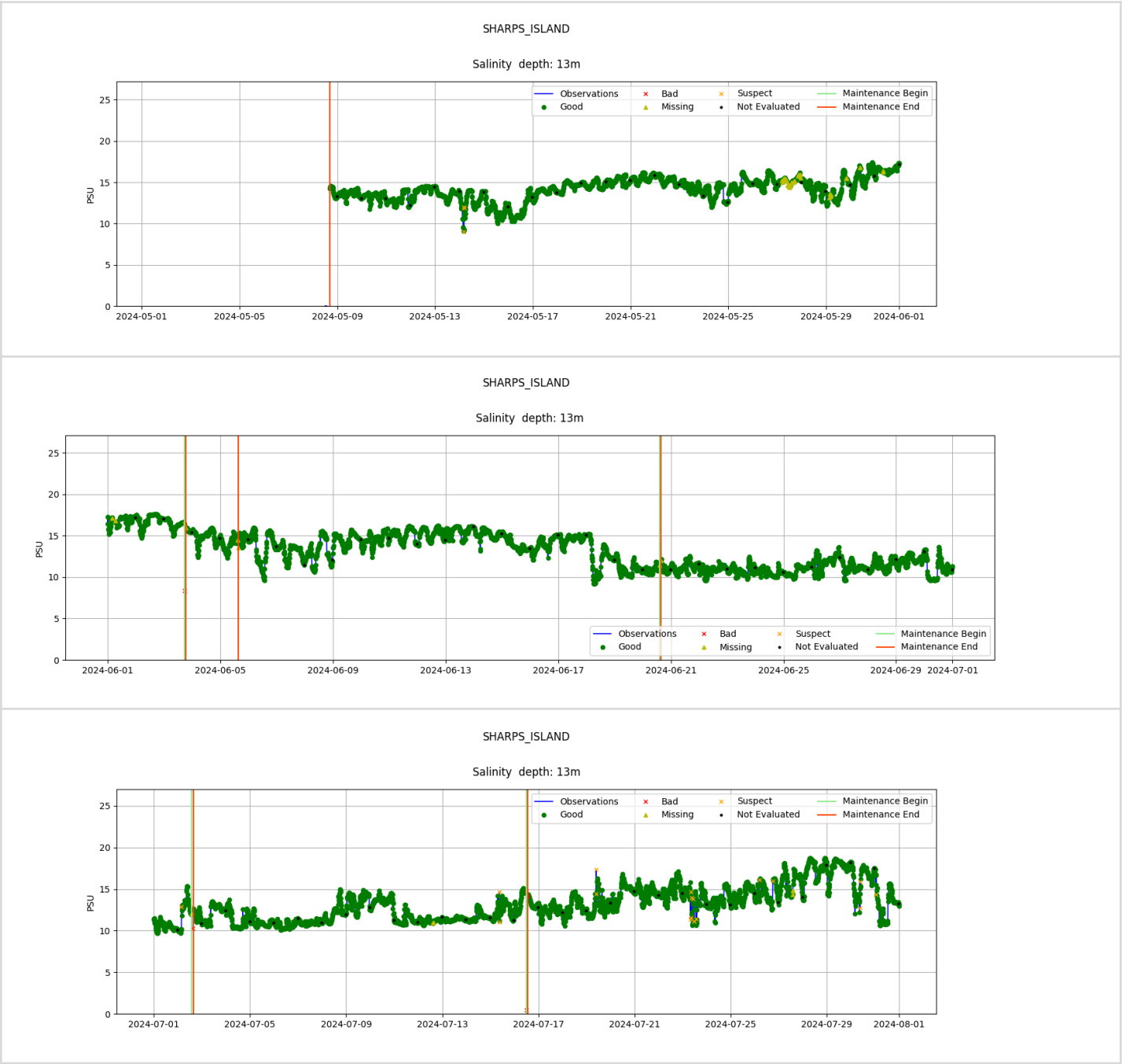
Sharps Island 13m Conductivity

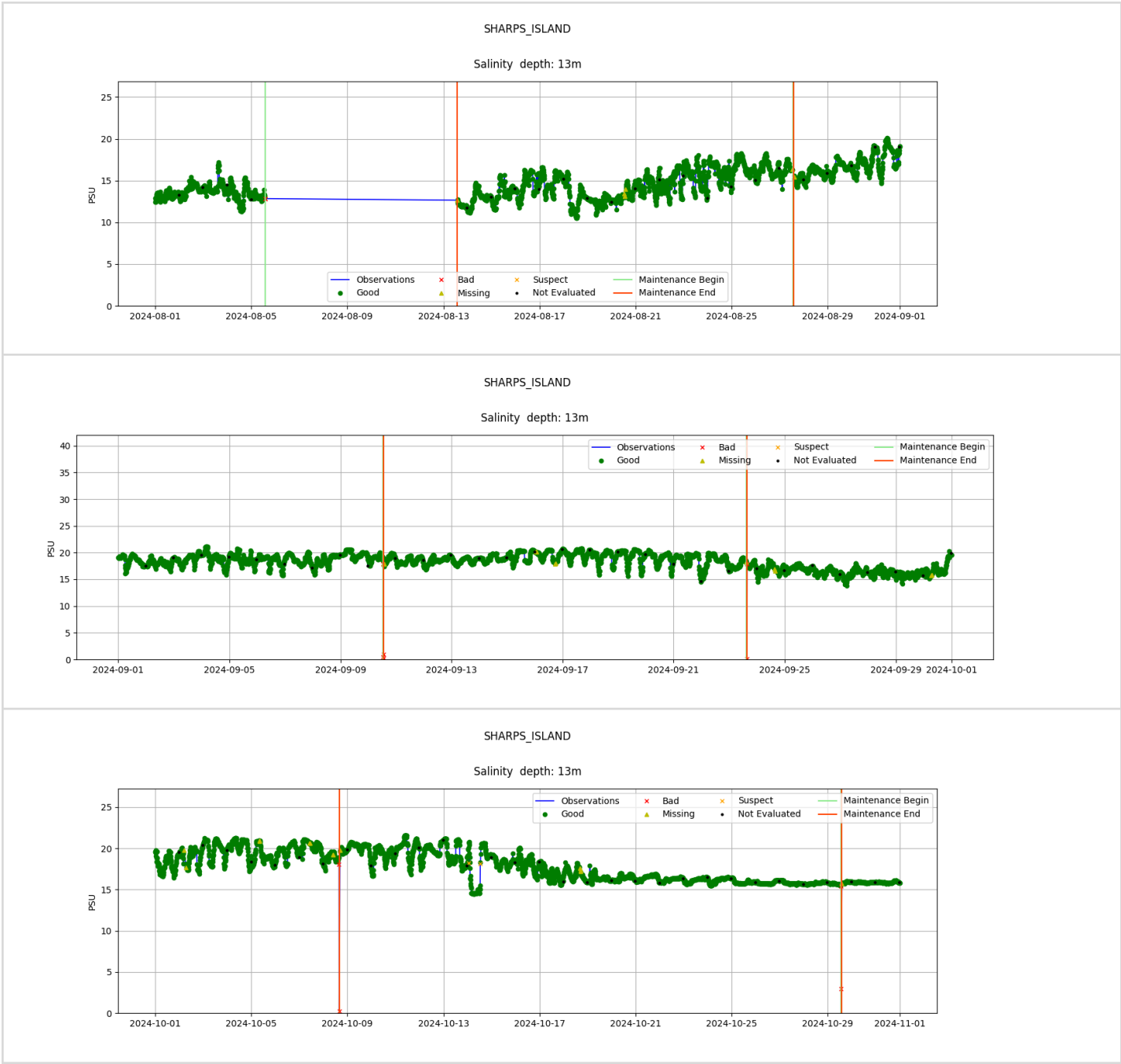


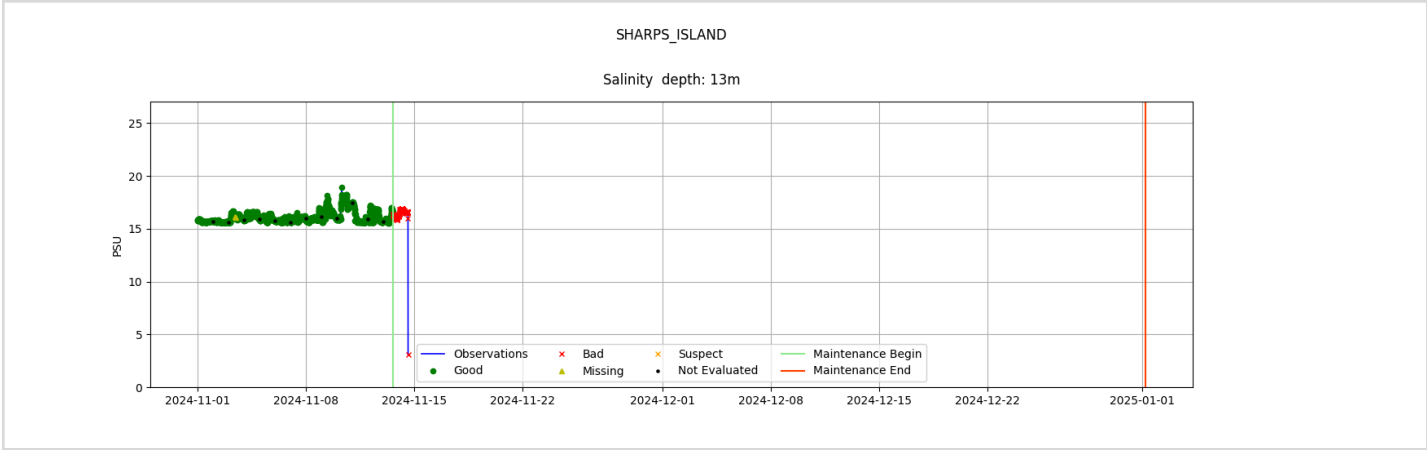




Sharps Island 13m Salinity

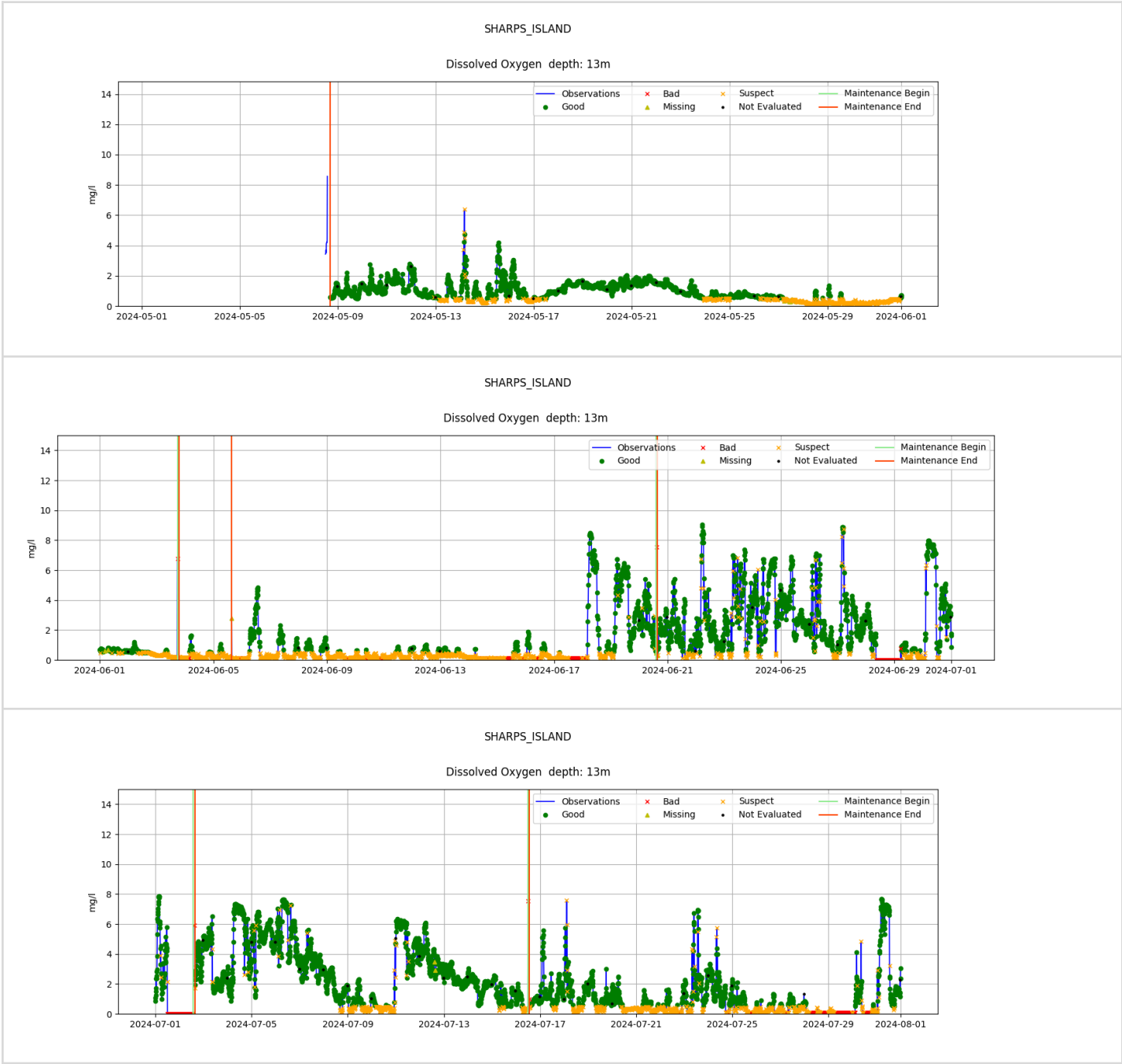


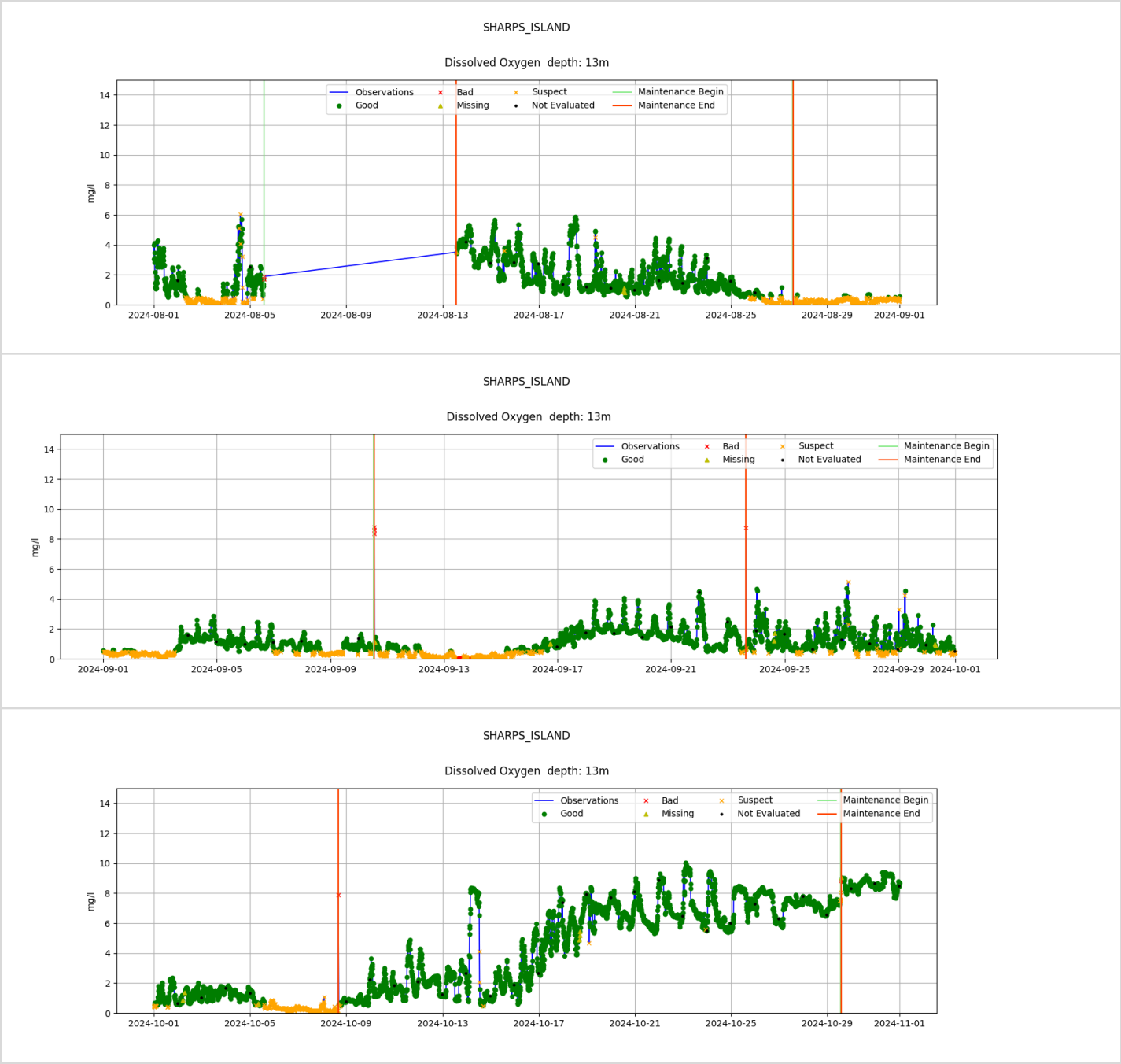


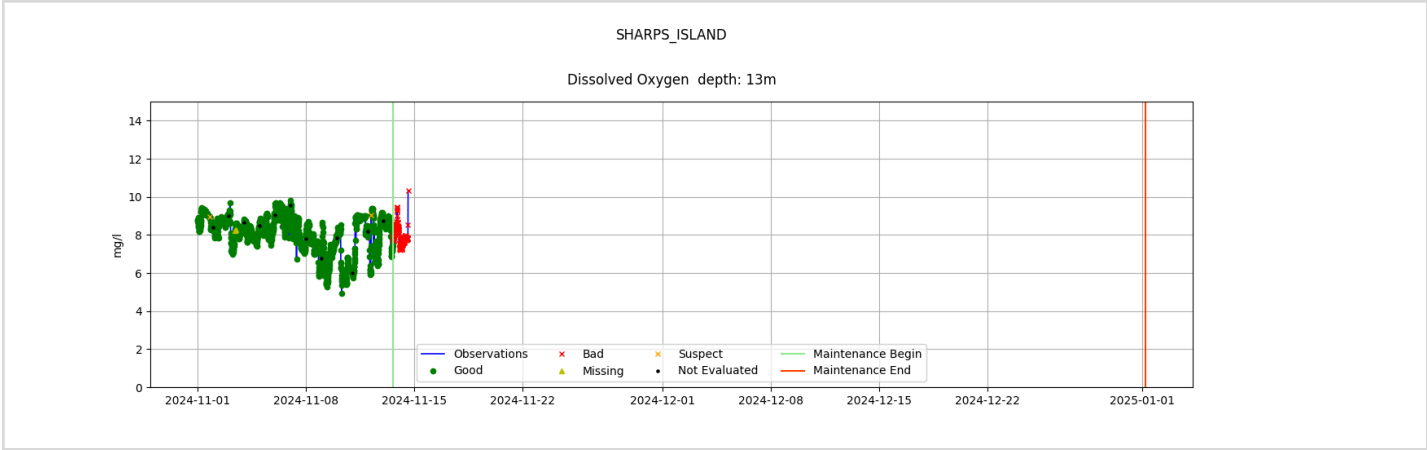




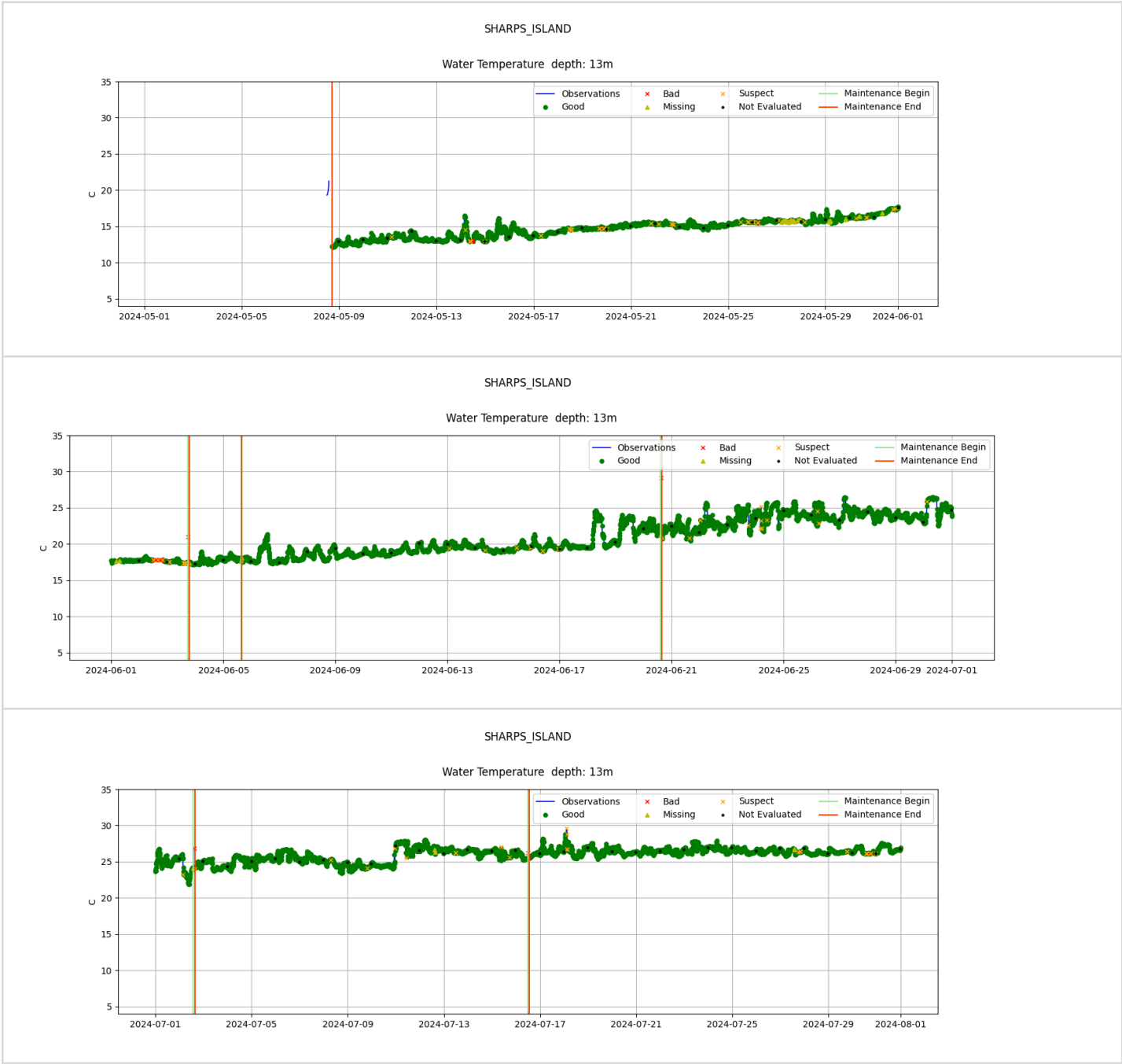
Sharps Island 13m Dissolved Oxygen

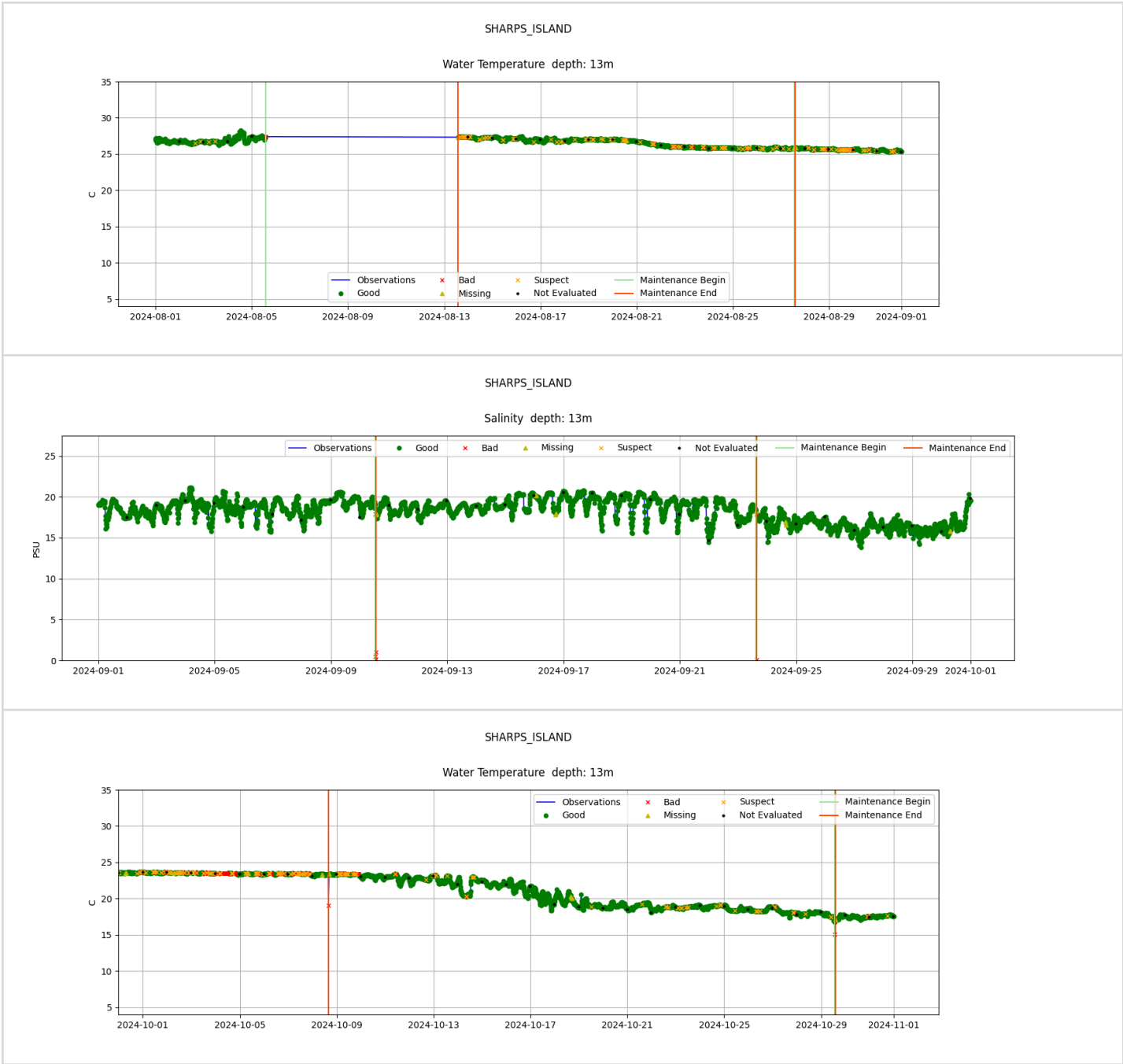


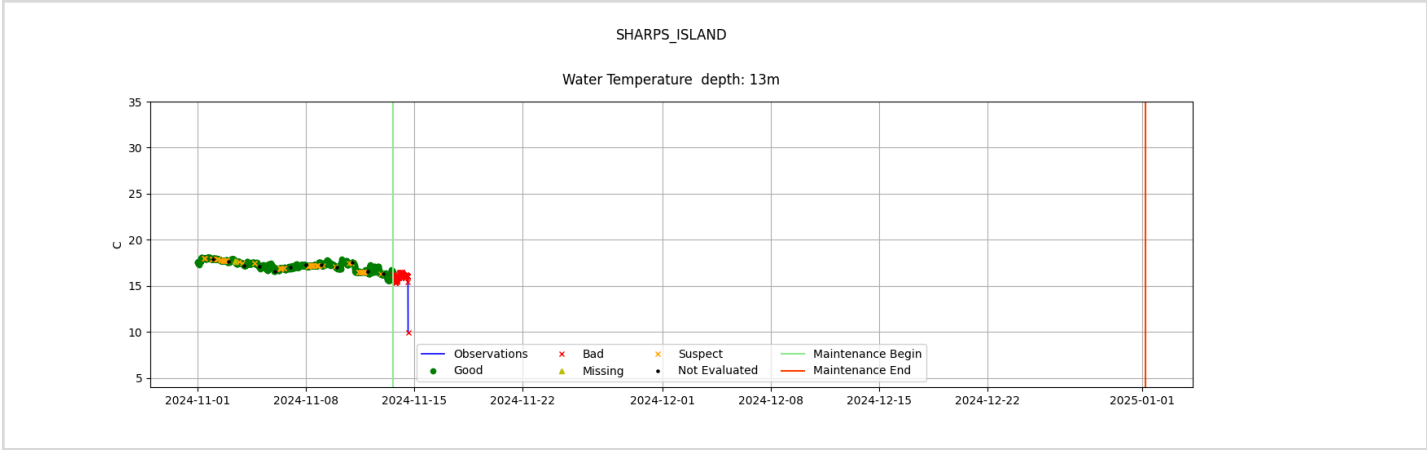




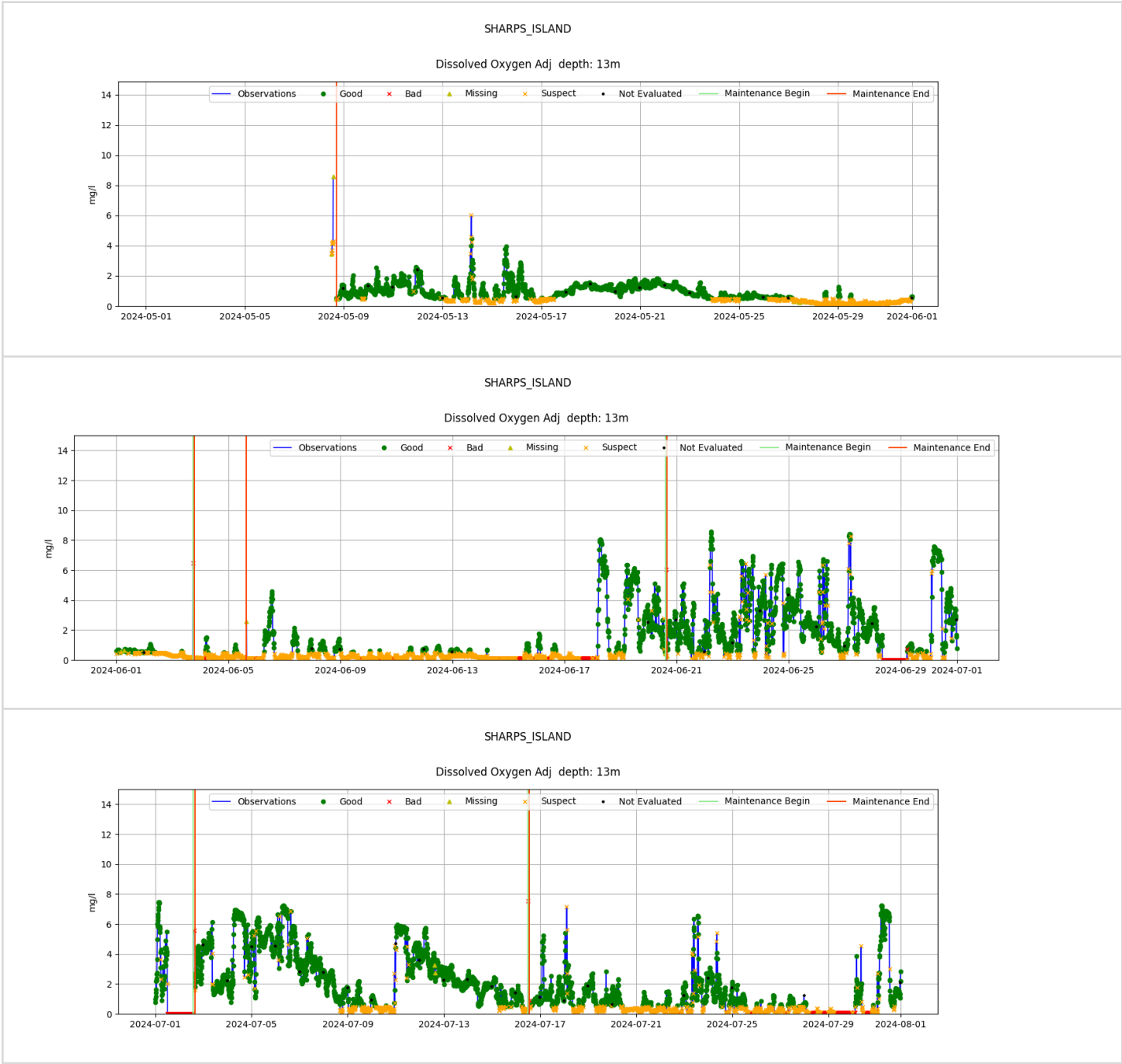
Sharps Island 13m Water Temperature





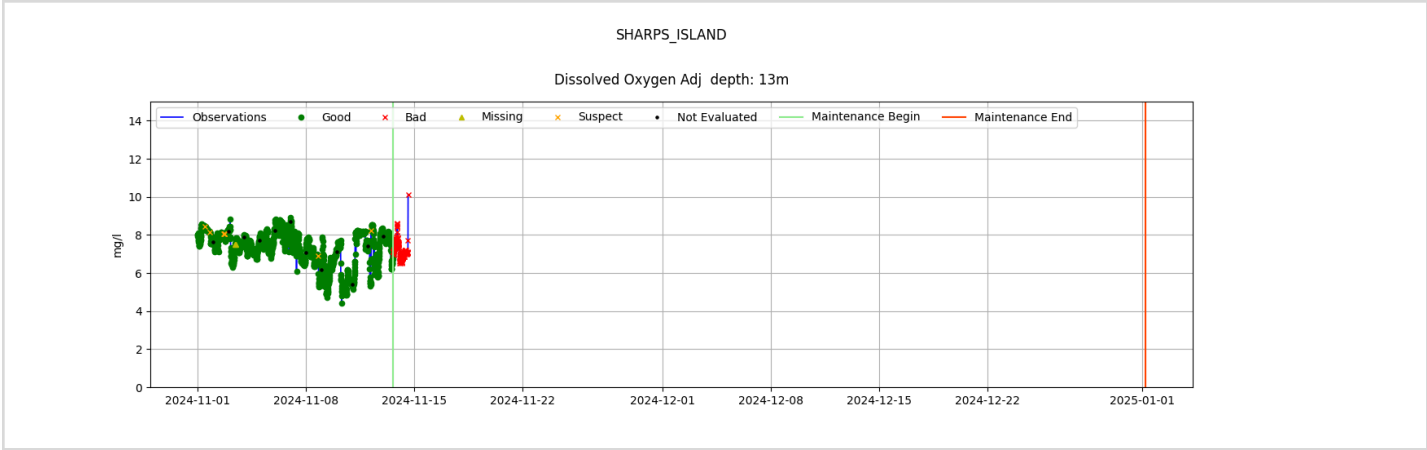


Sharps Island 13m Dissolved Oxygen Adjusted

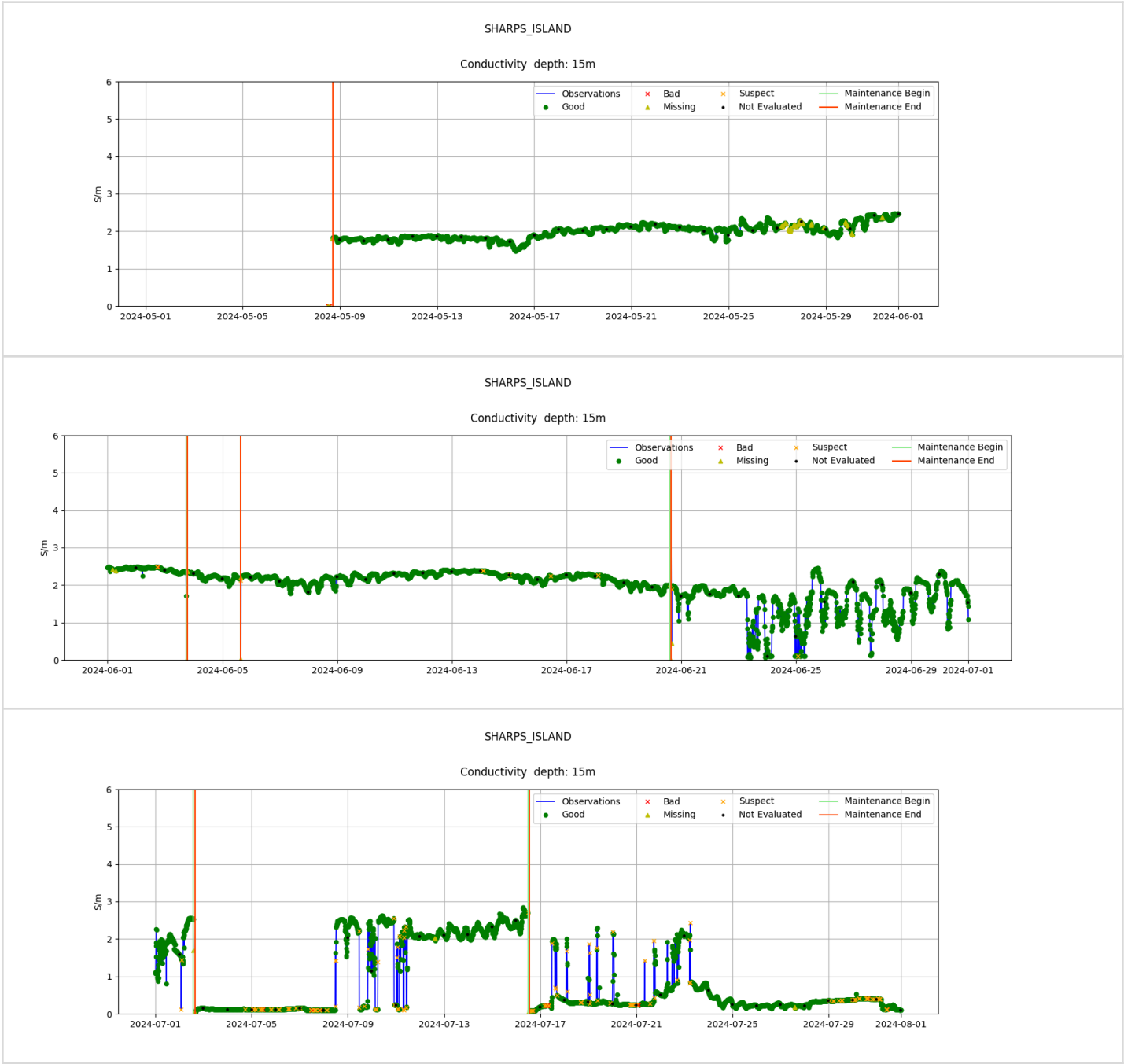


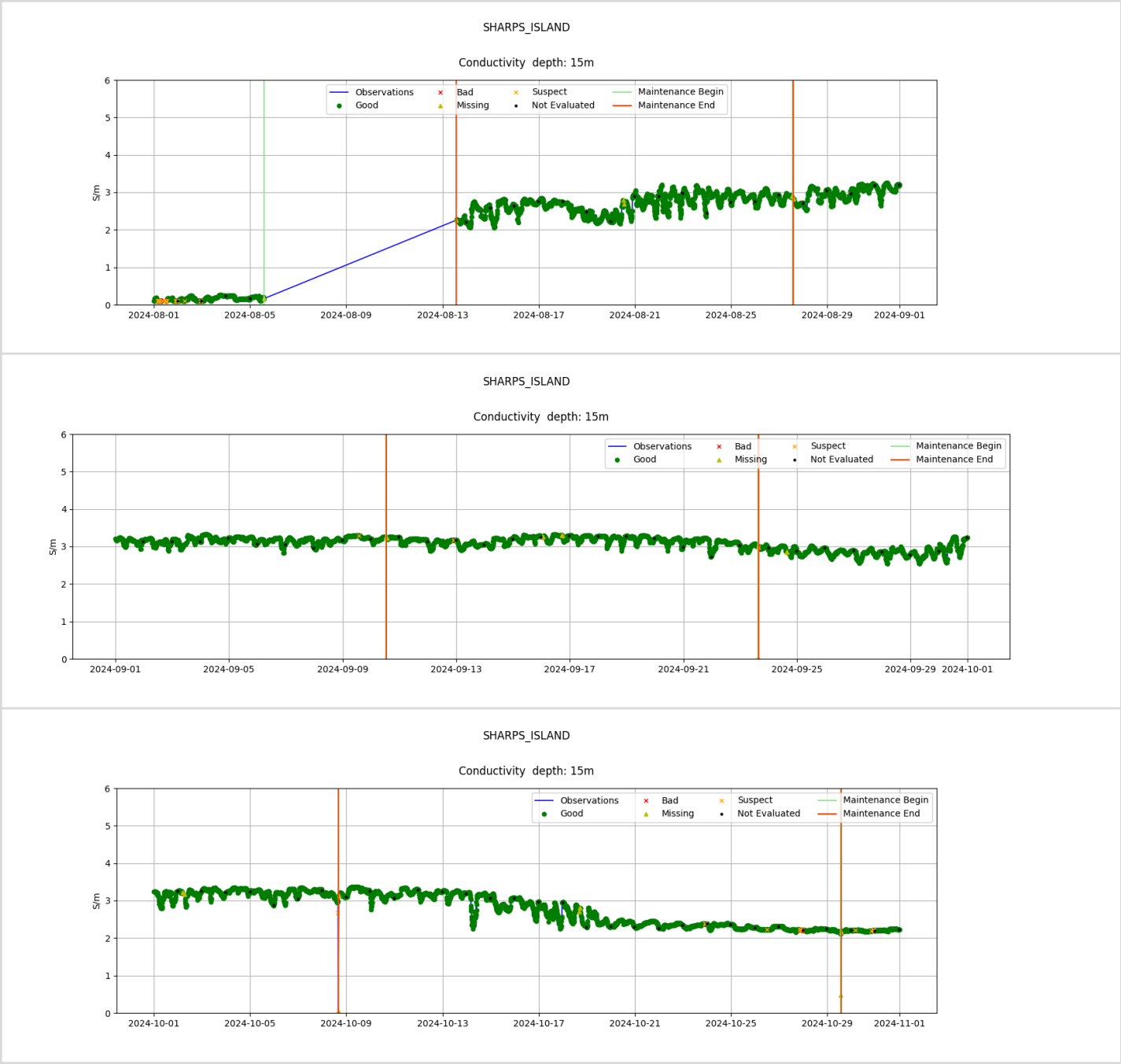


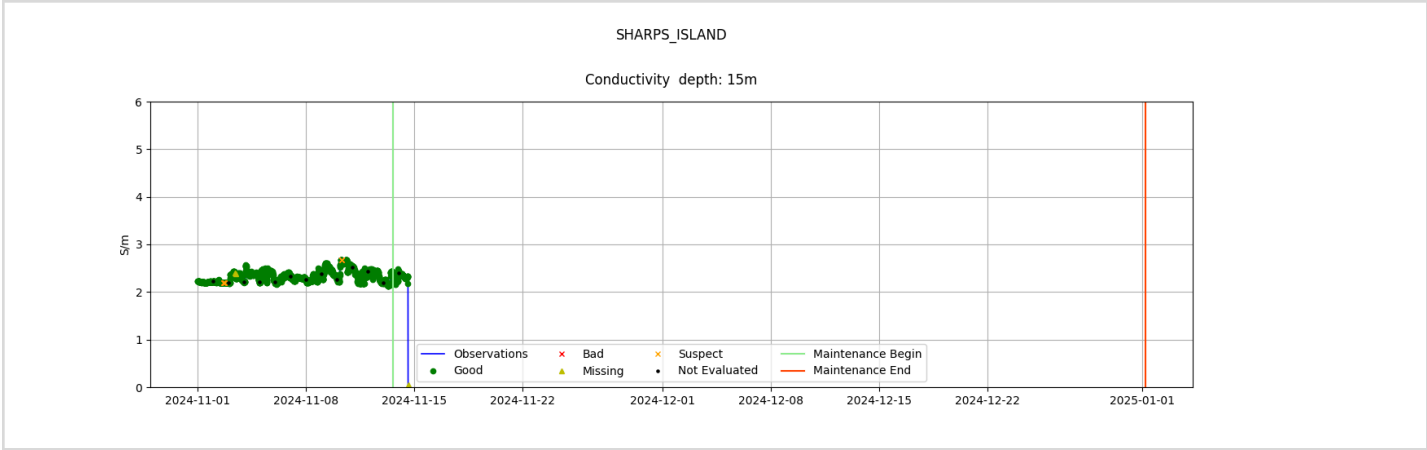




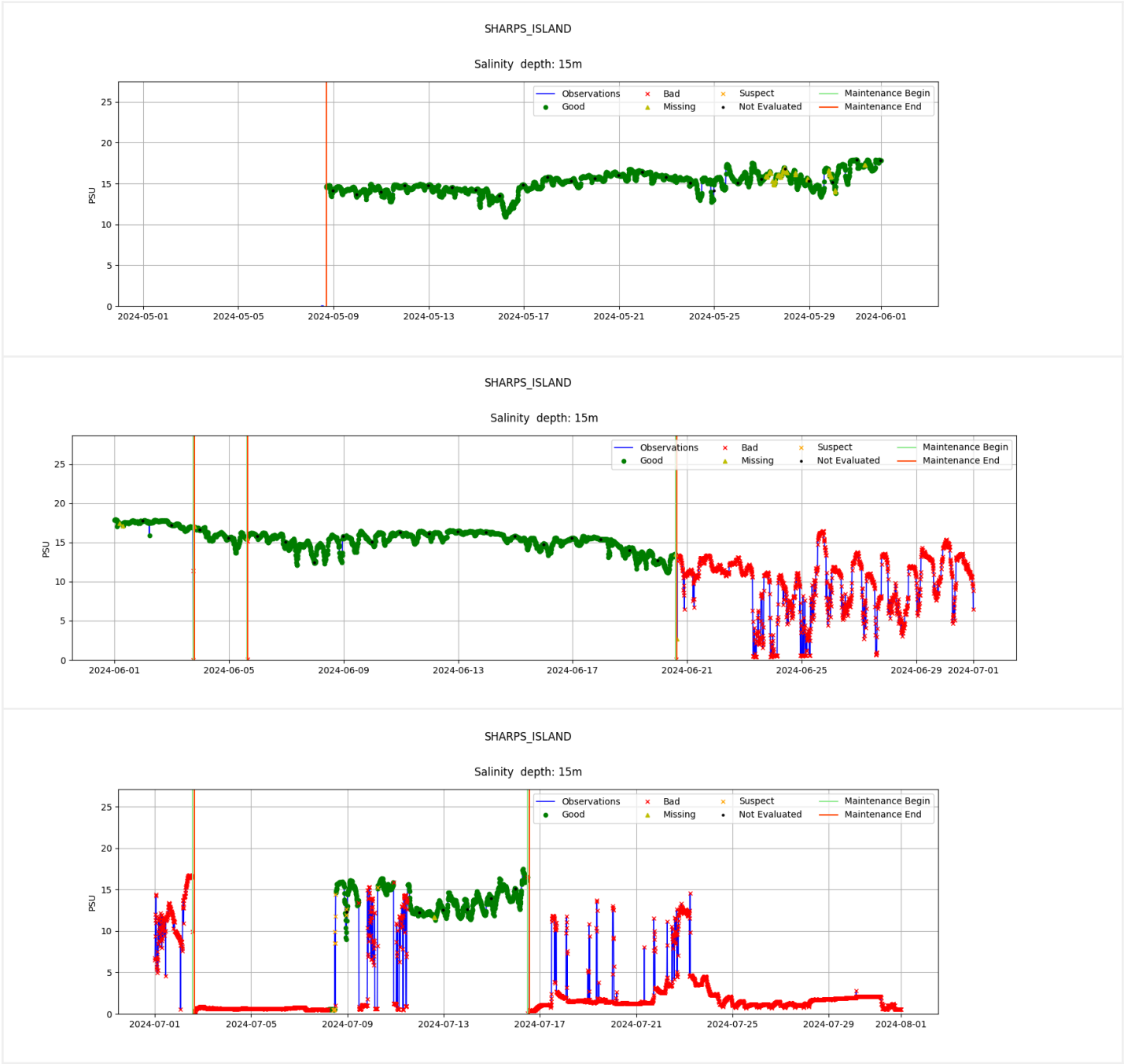
Sharps Island 15m Conductivity

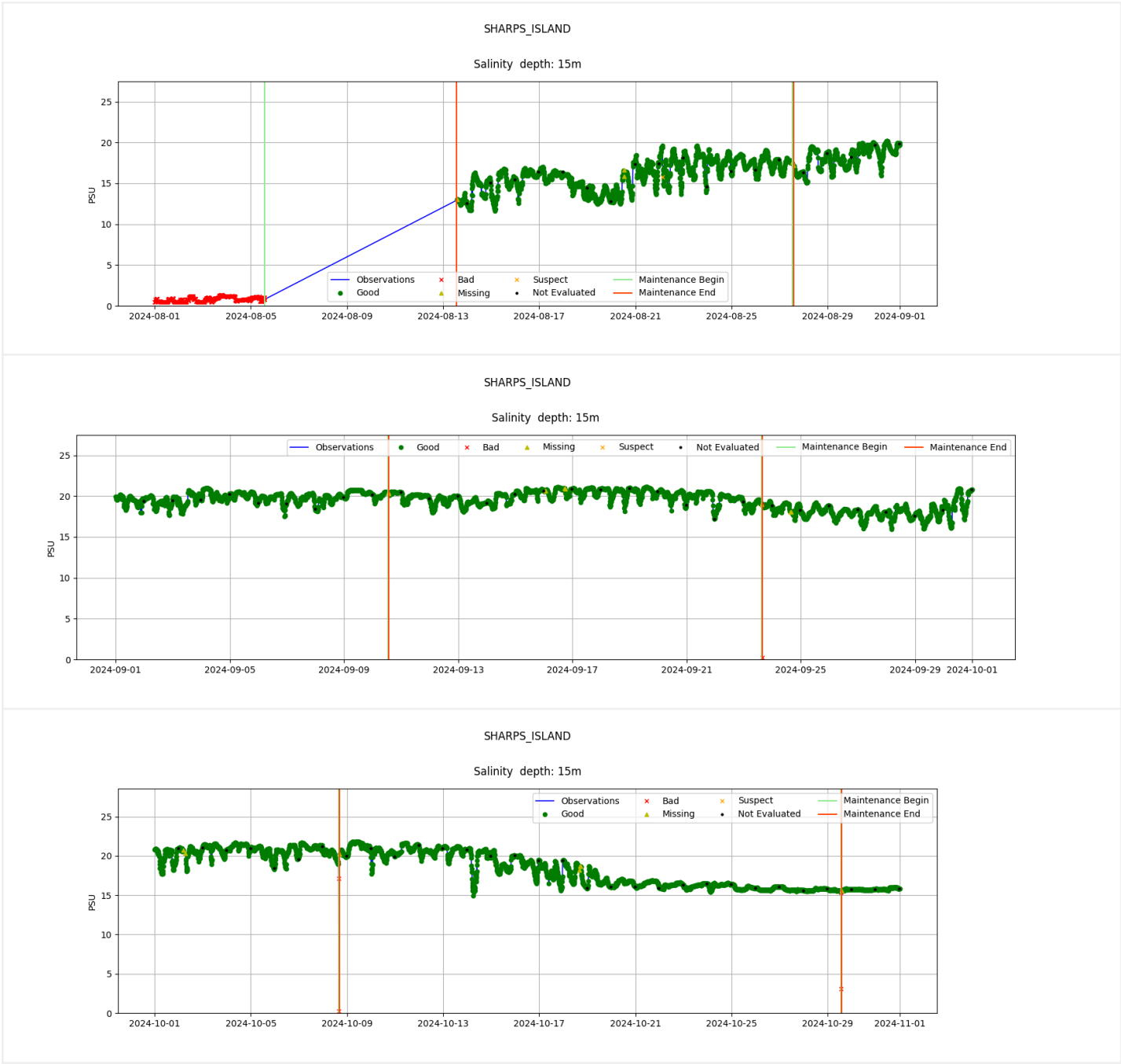


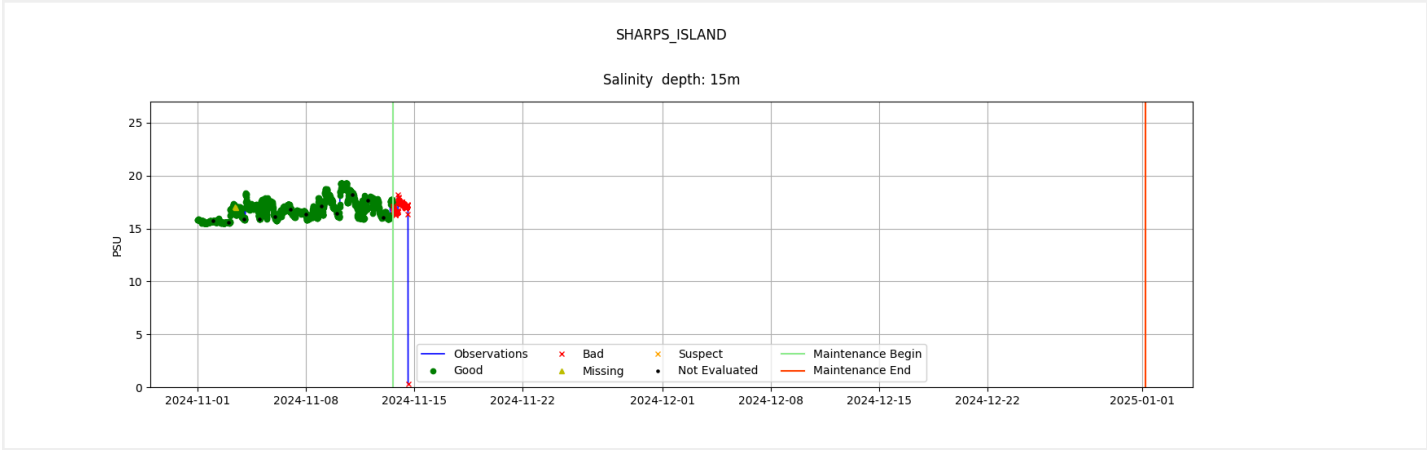




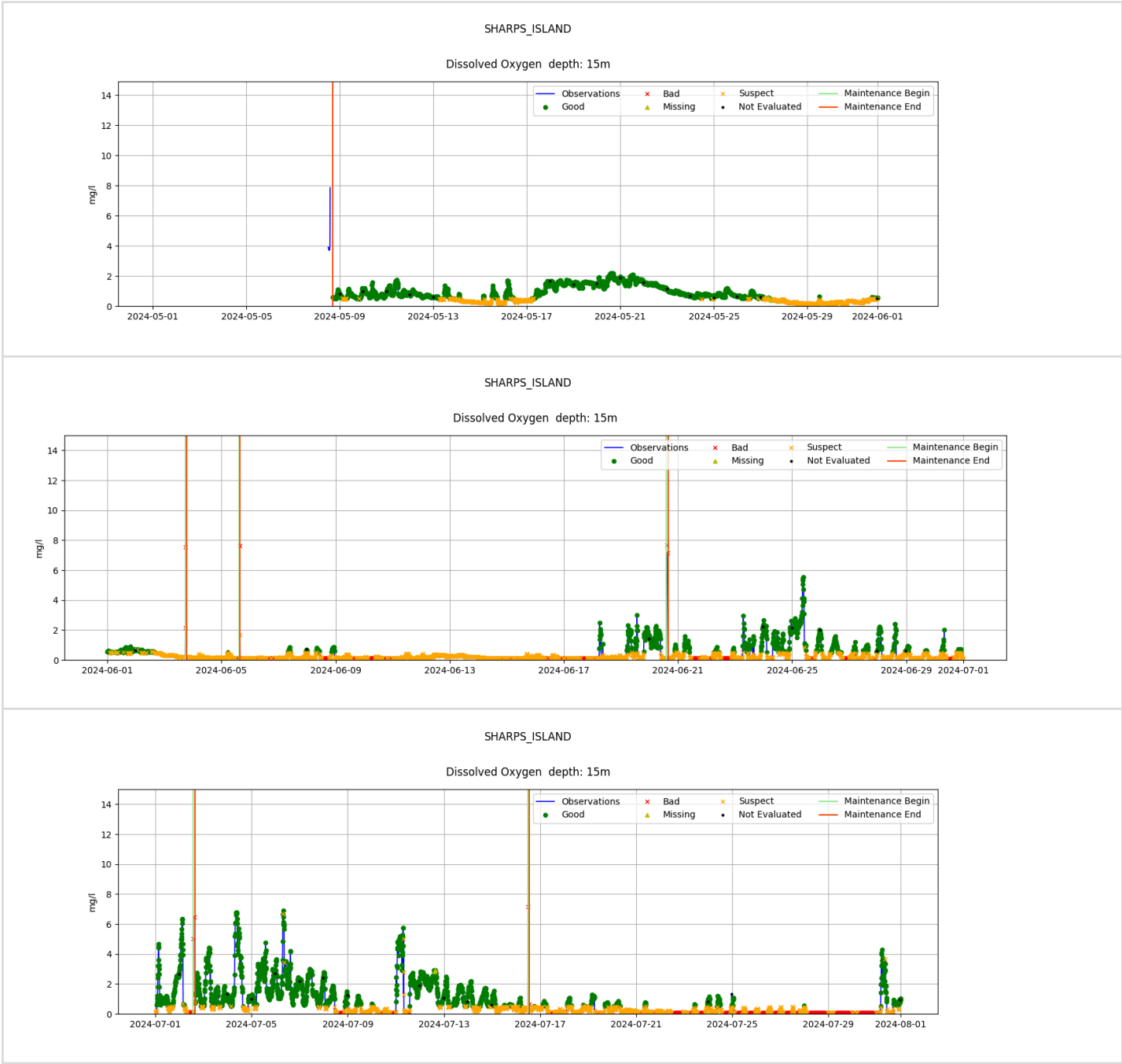
Sharps Island 15m Salinity



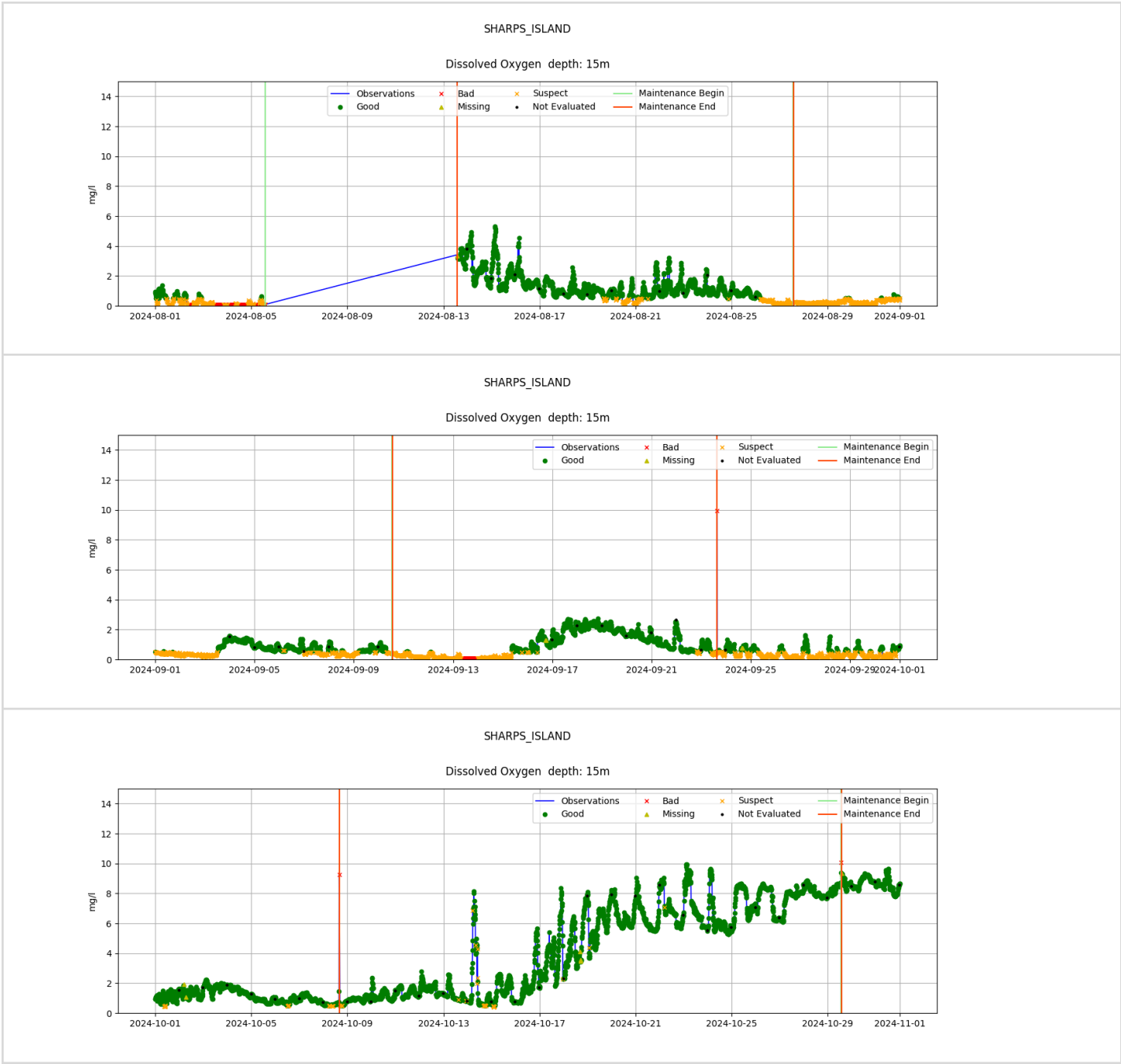


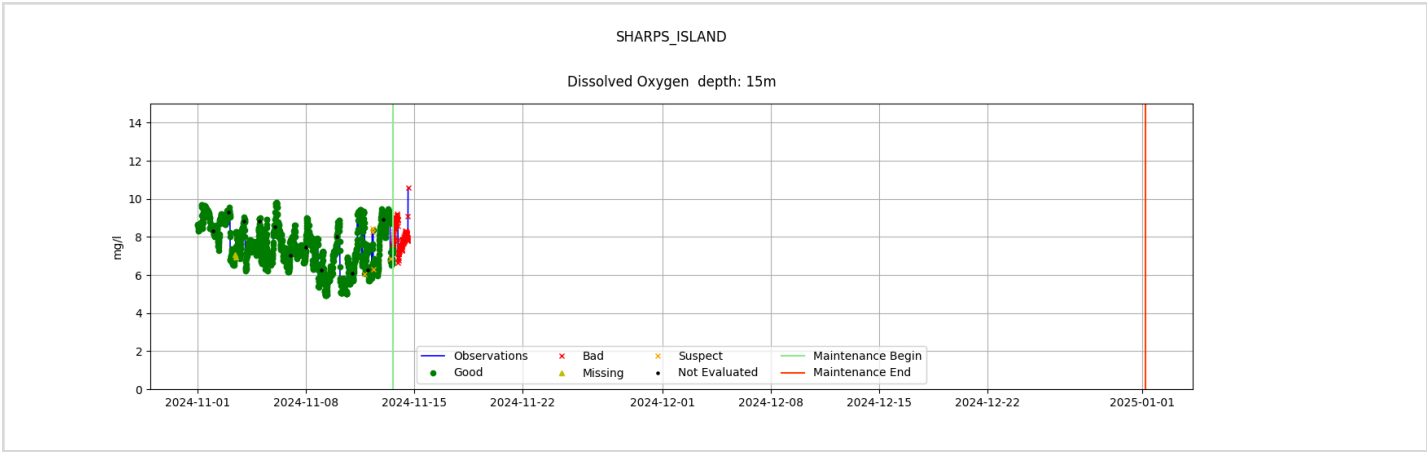


Sharps Island 15m Dissolved Oxygen

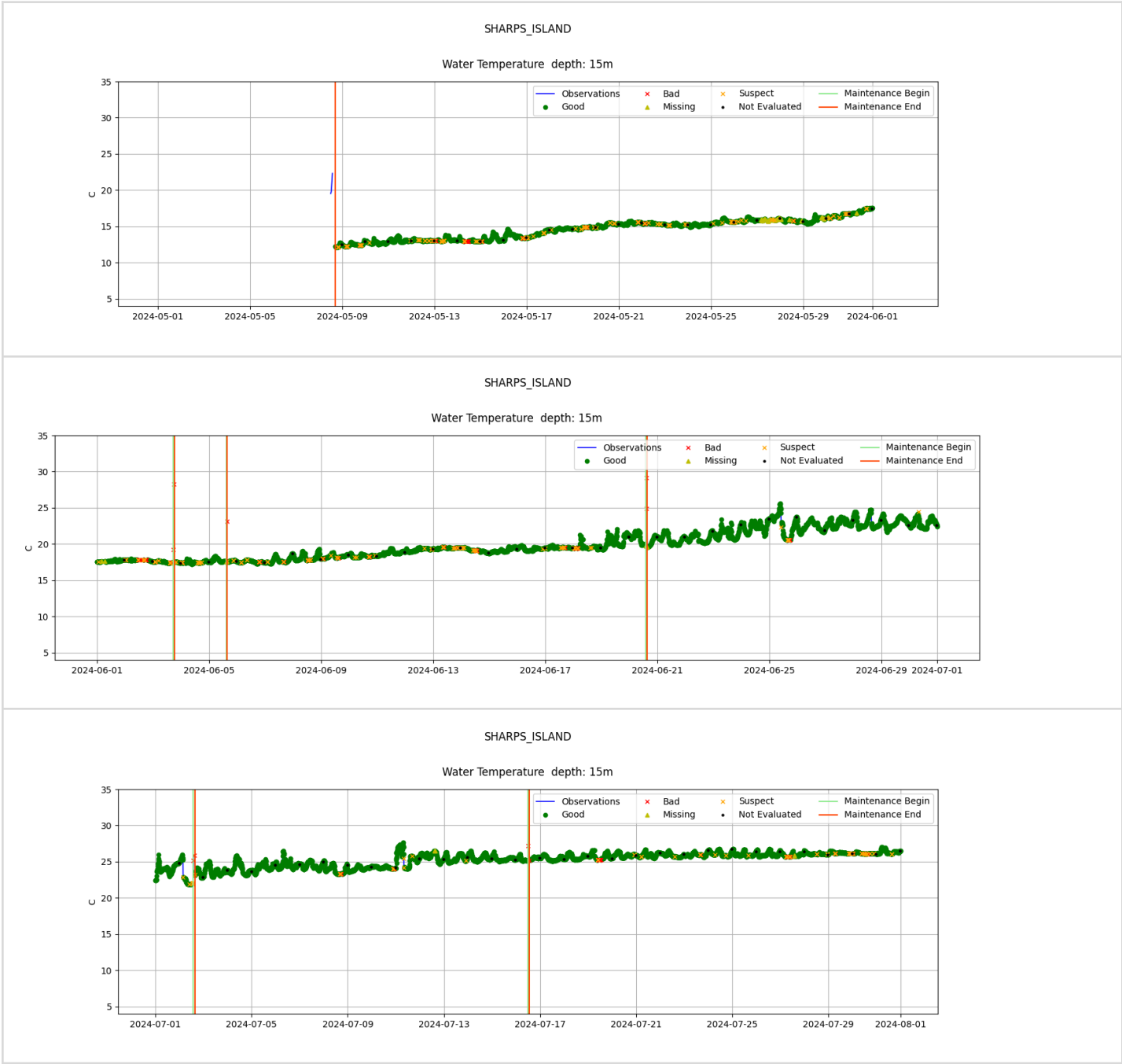


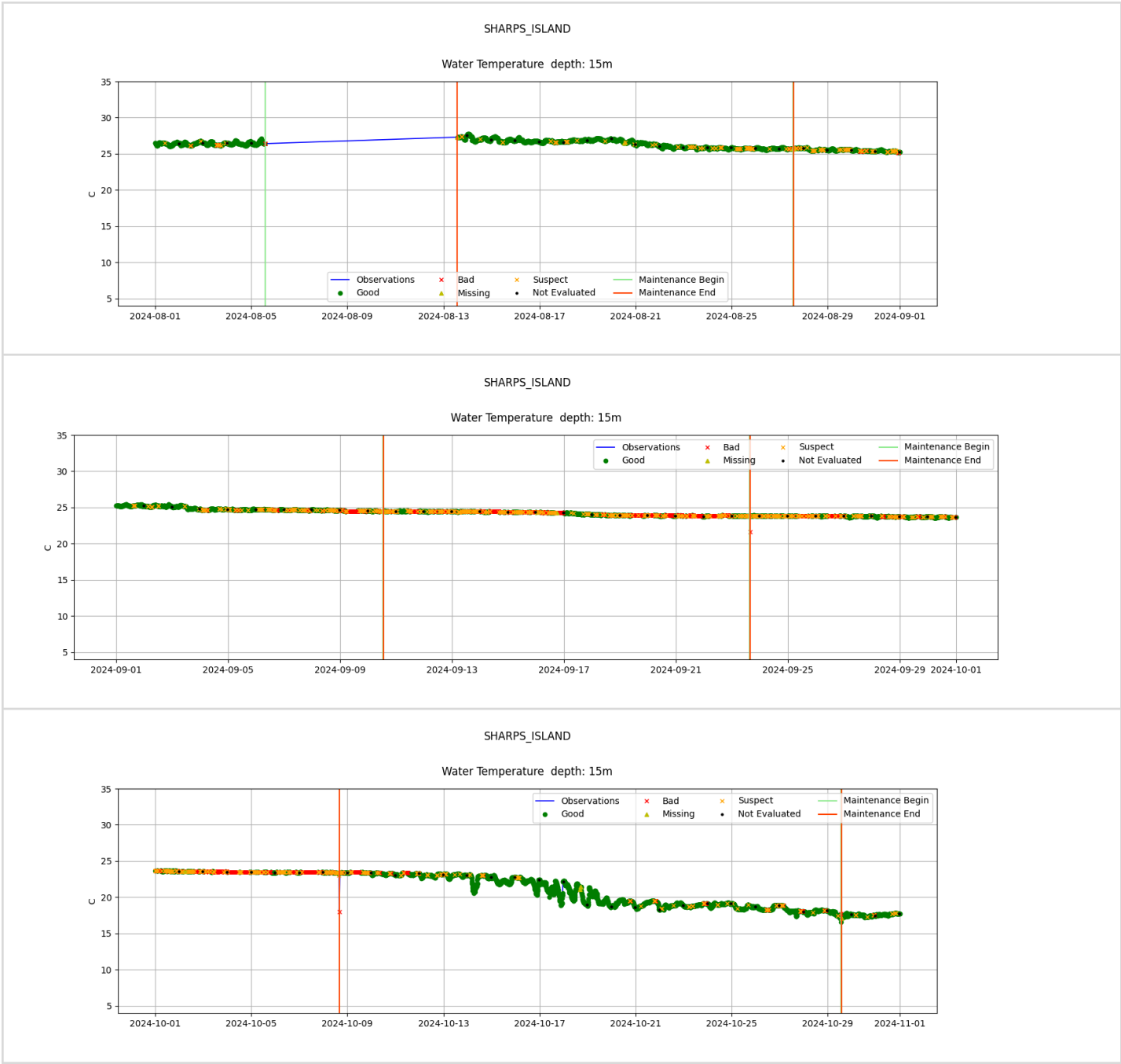


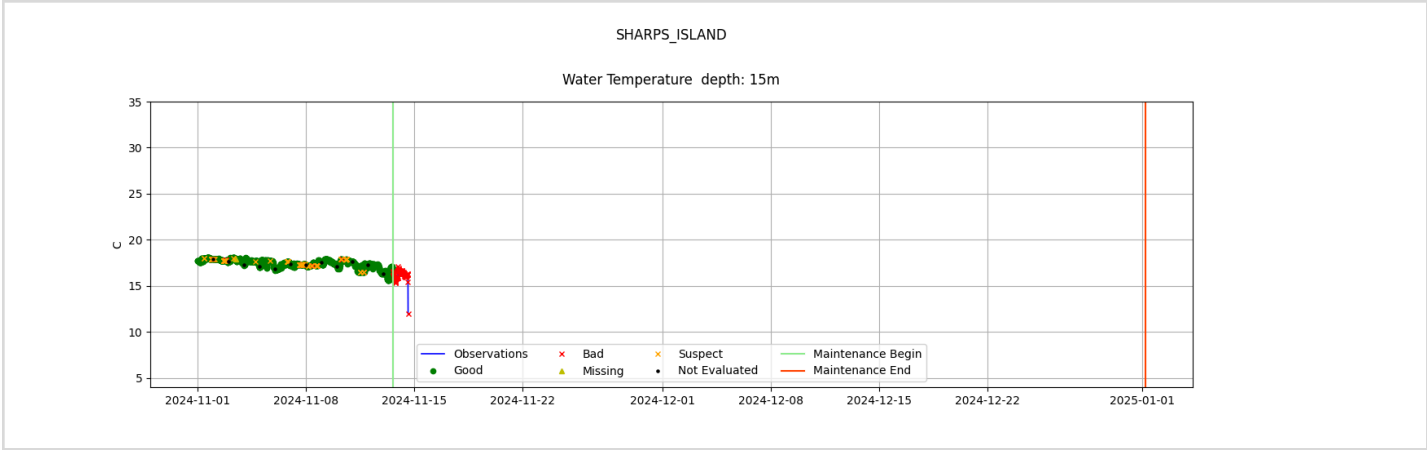




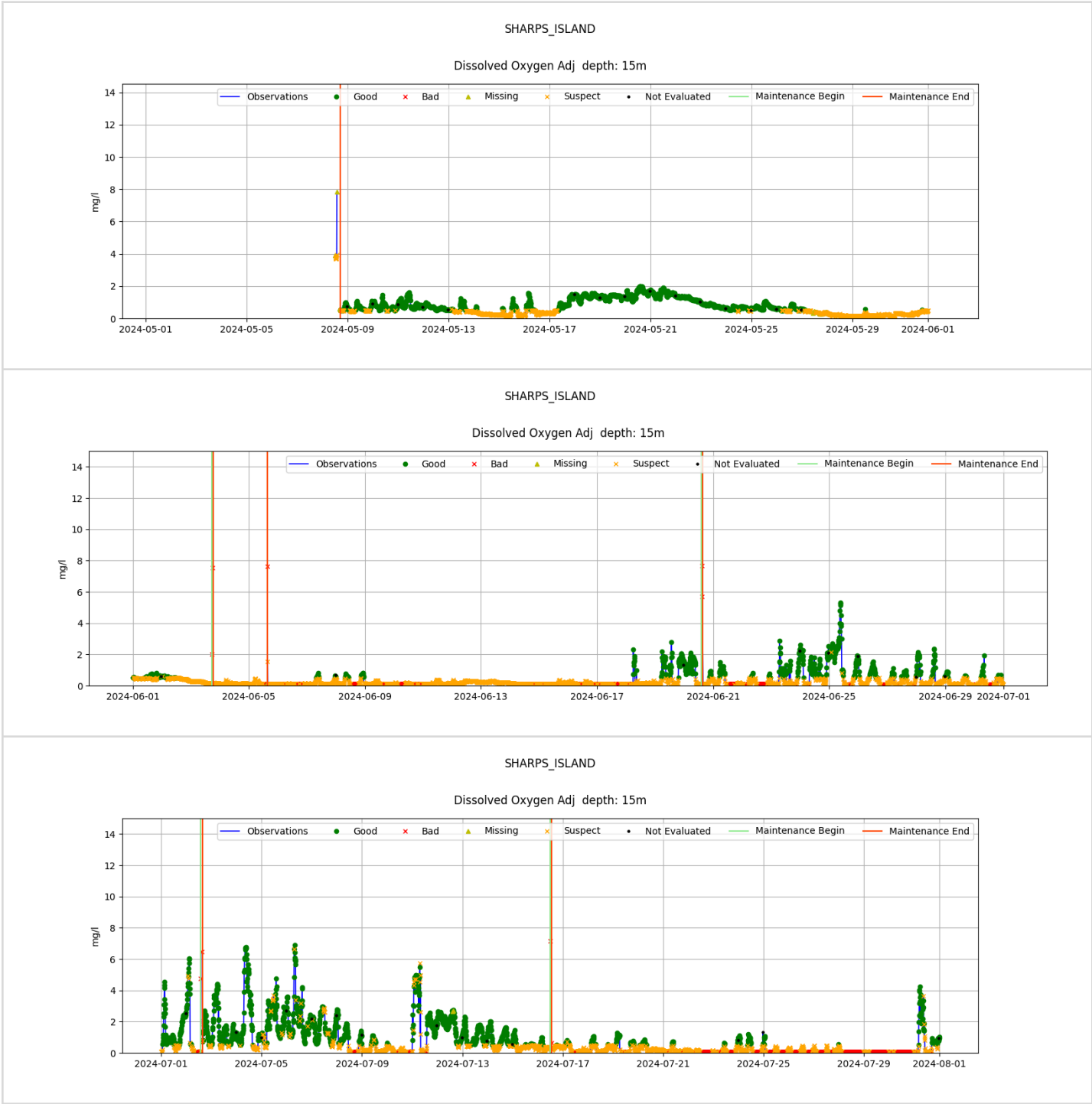
Sharps Island 15m Water Temperature

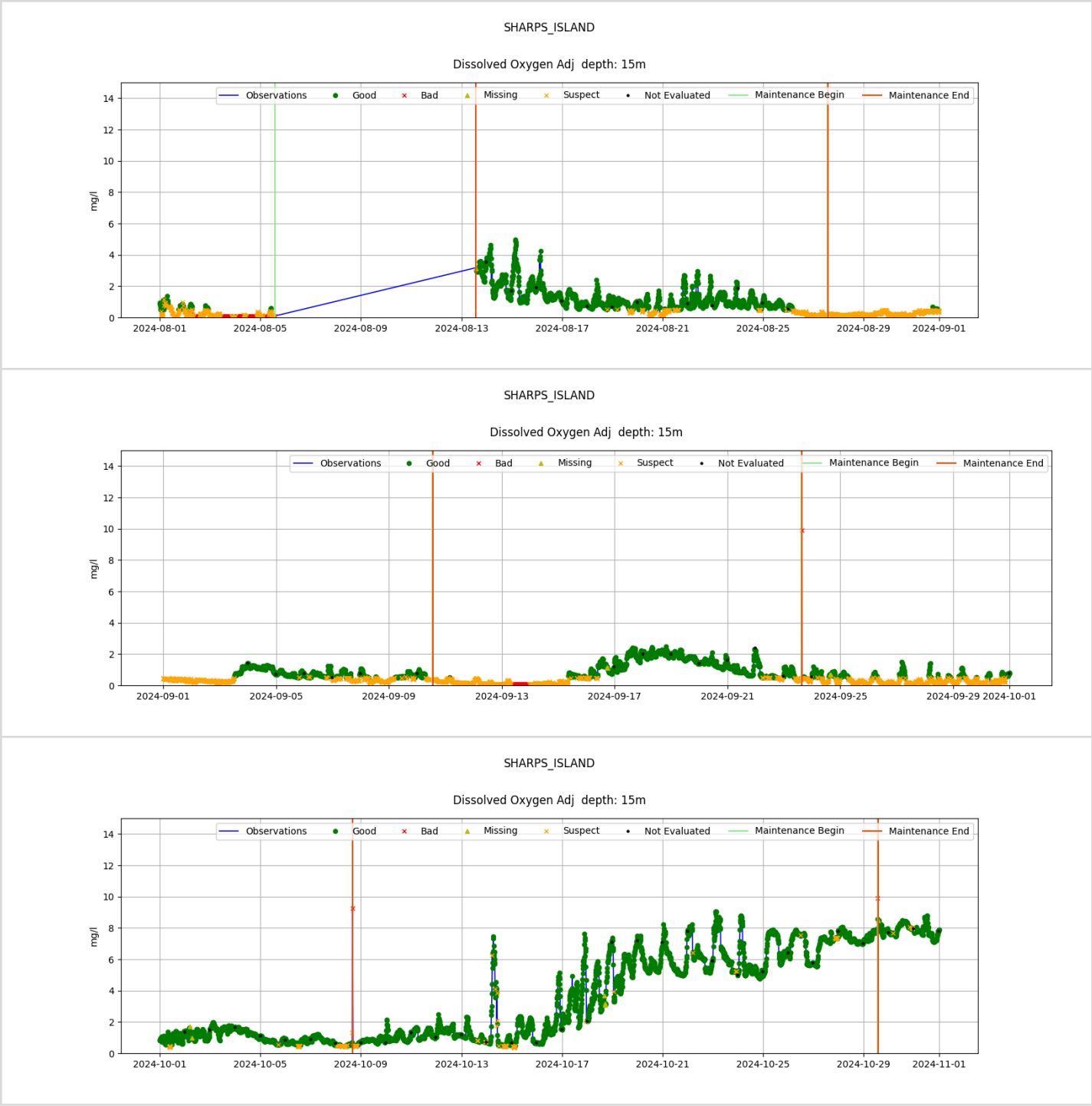


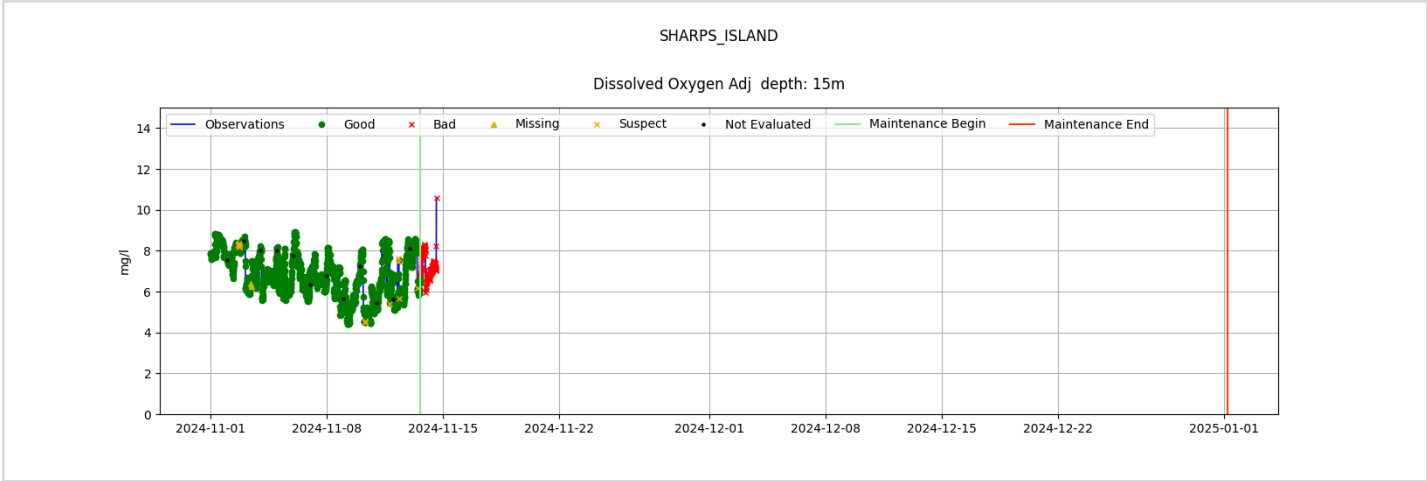




Sharps Island 15m Dissolved Oxygen Adjusted



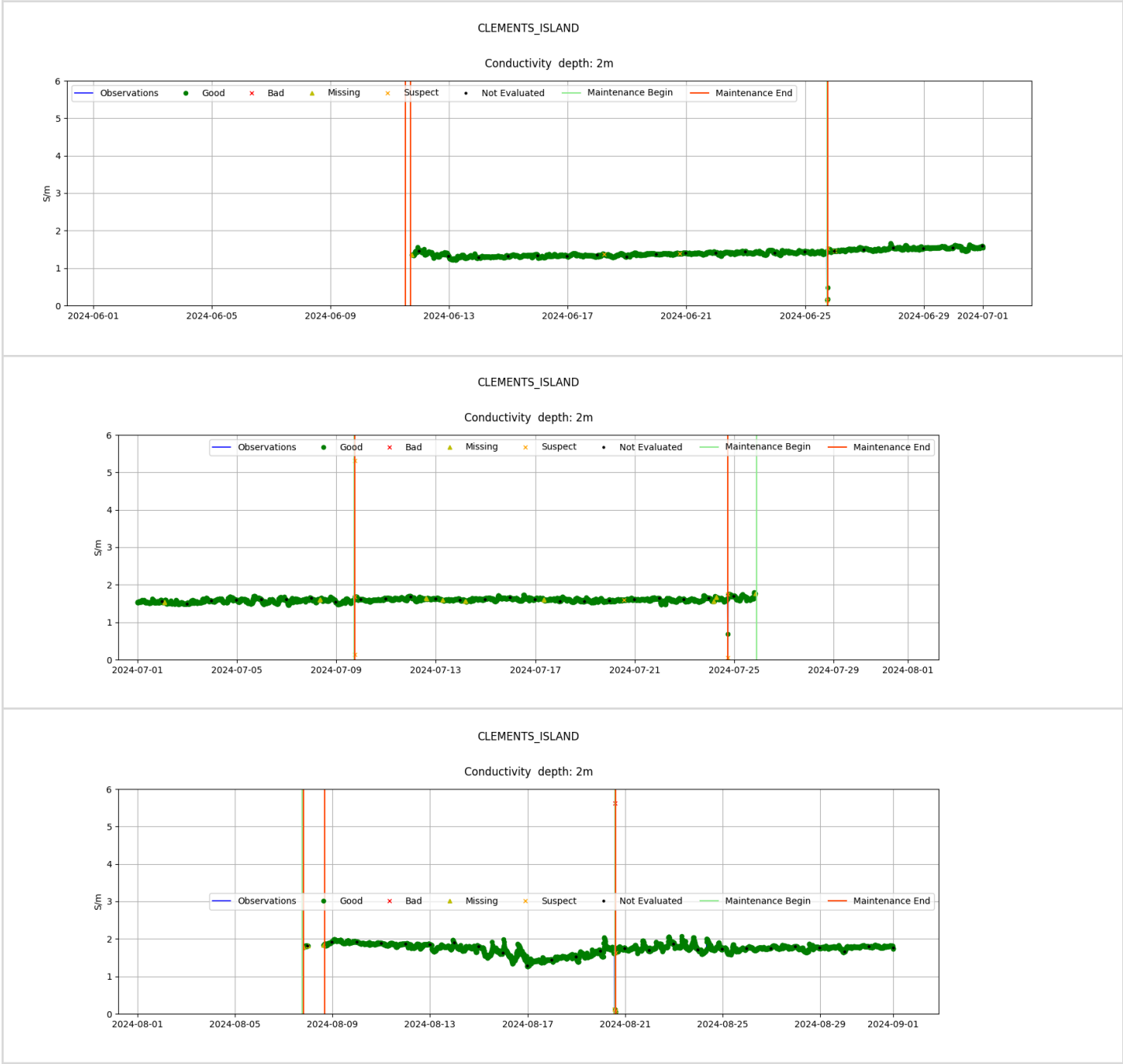


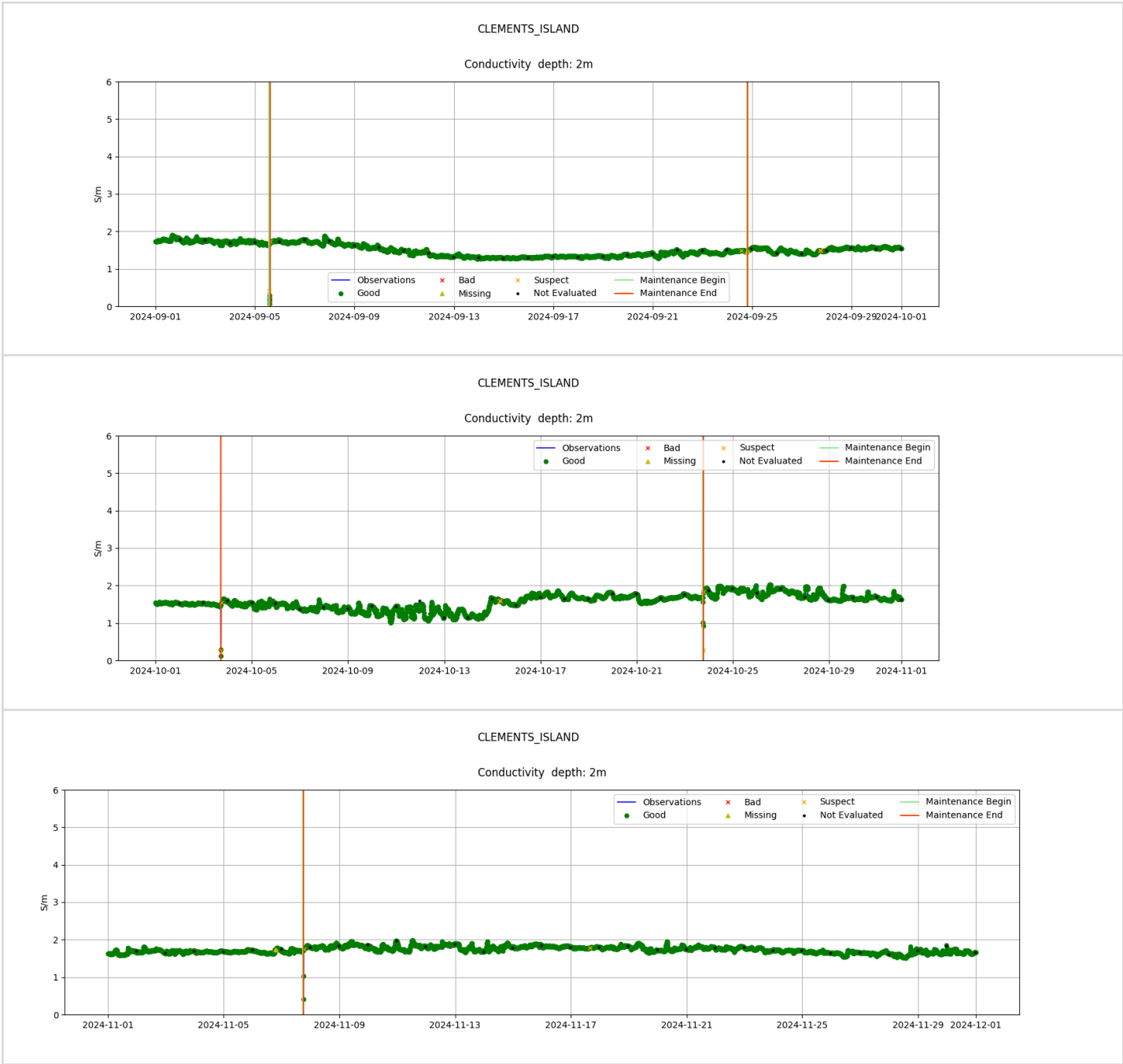


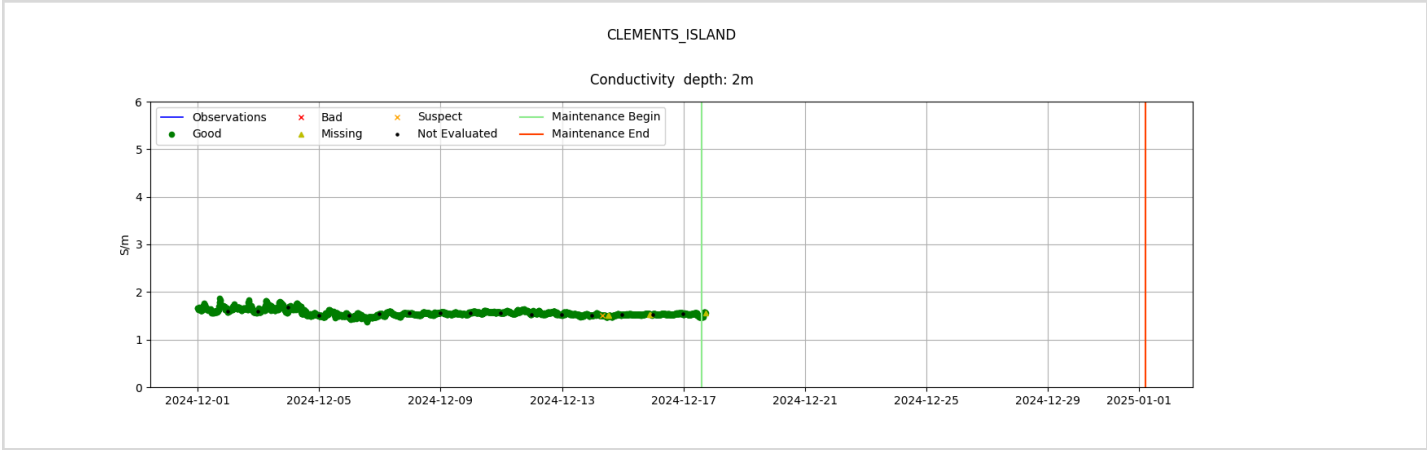


## 8.4 Clements Island

### Clements Island 2m Conductivity



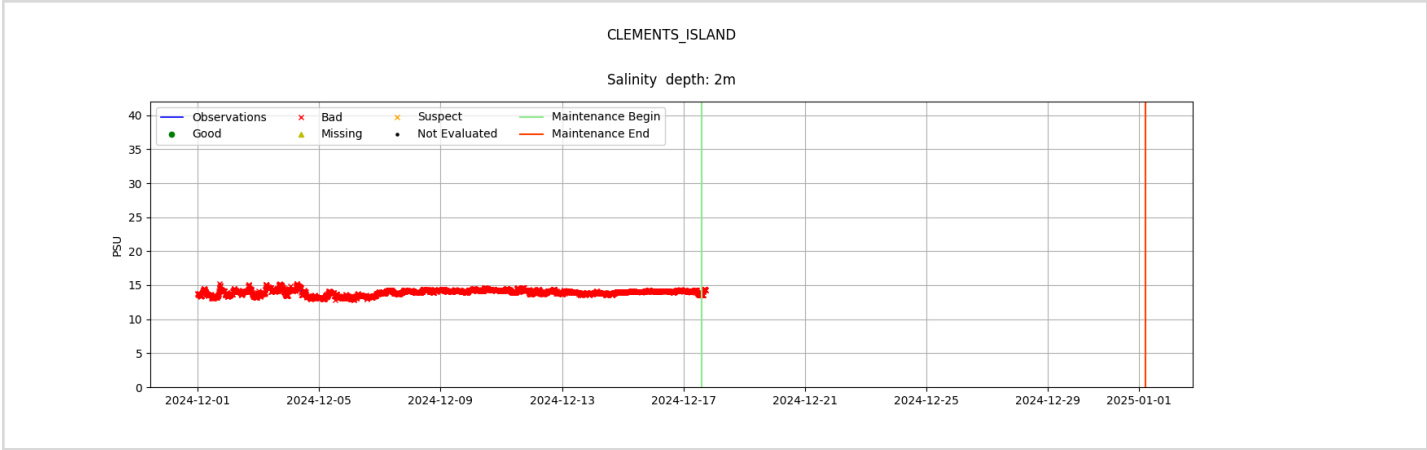




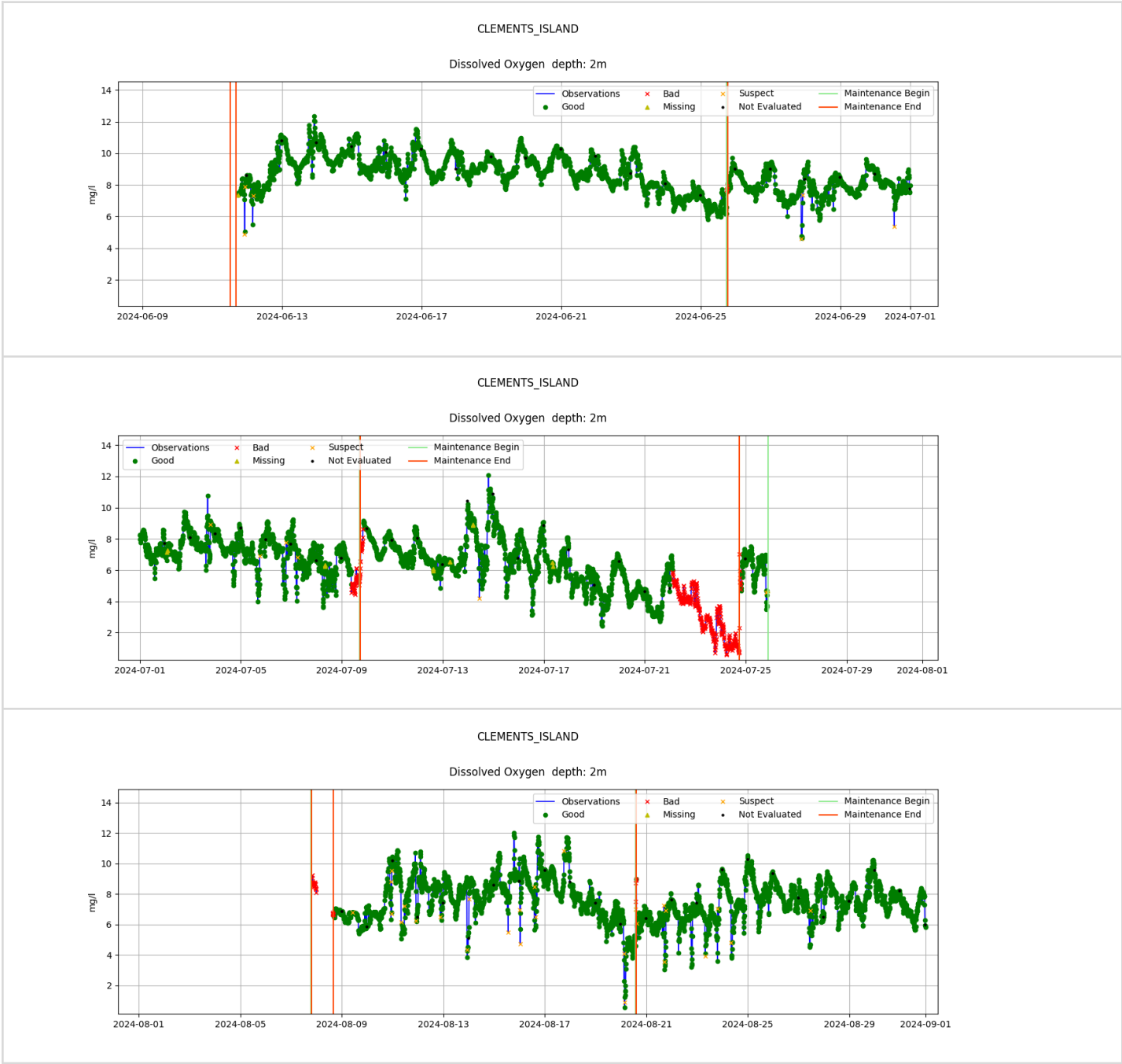
Clements Island 2m Salinity





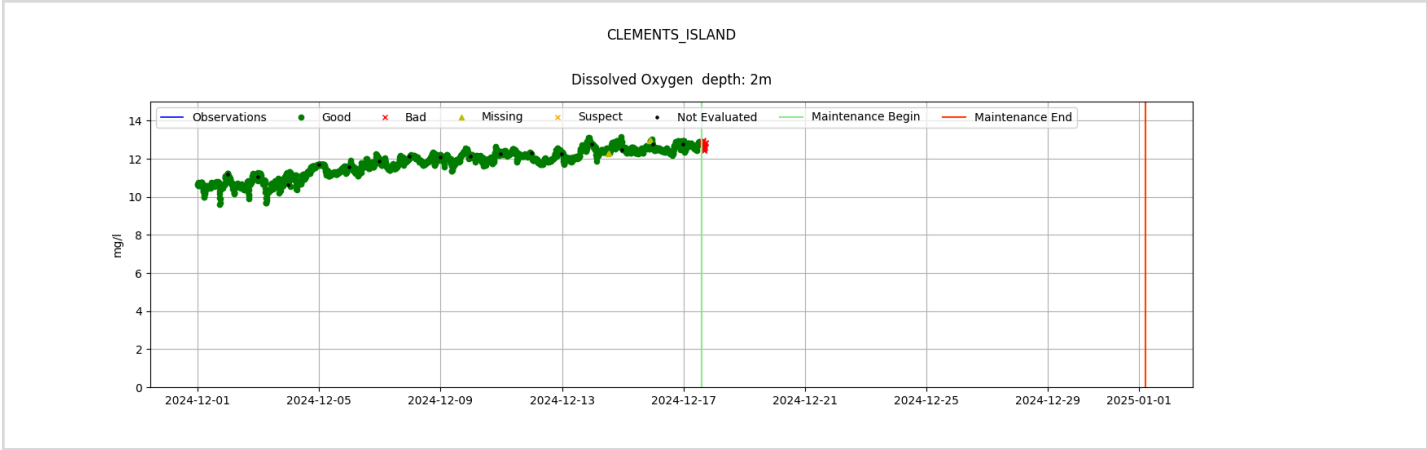


Clements Island 2m Dissolved Oxygen

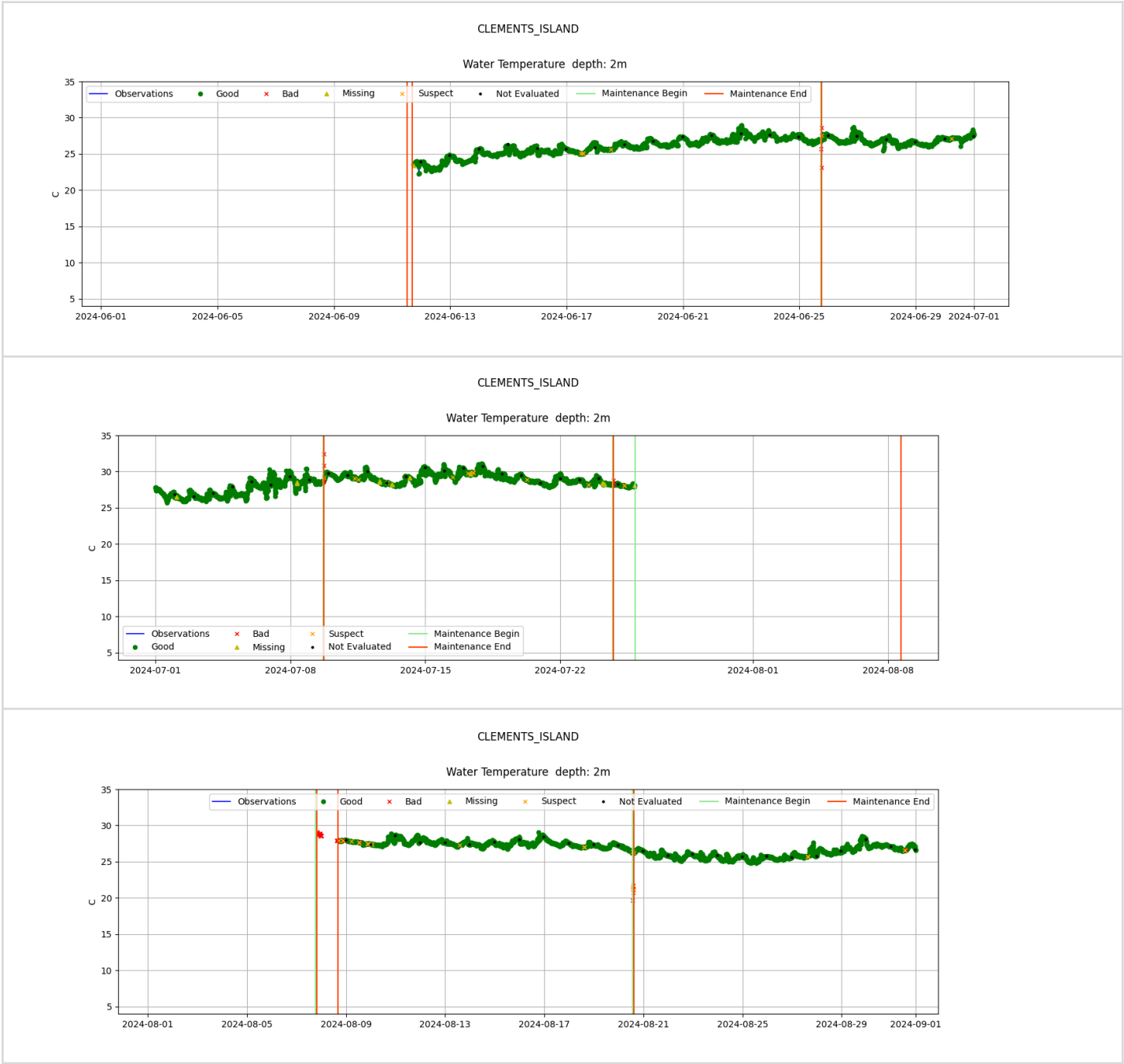


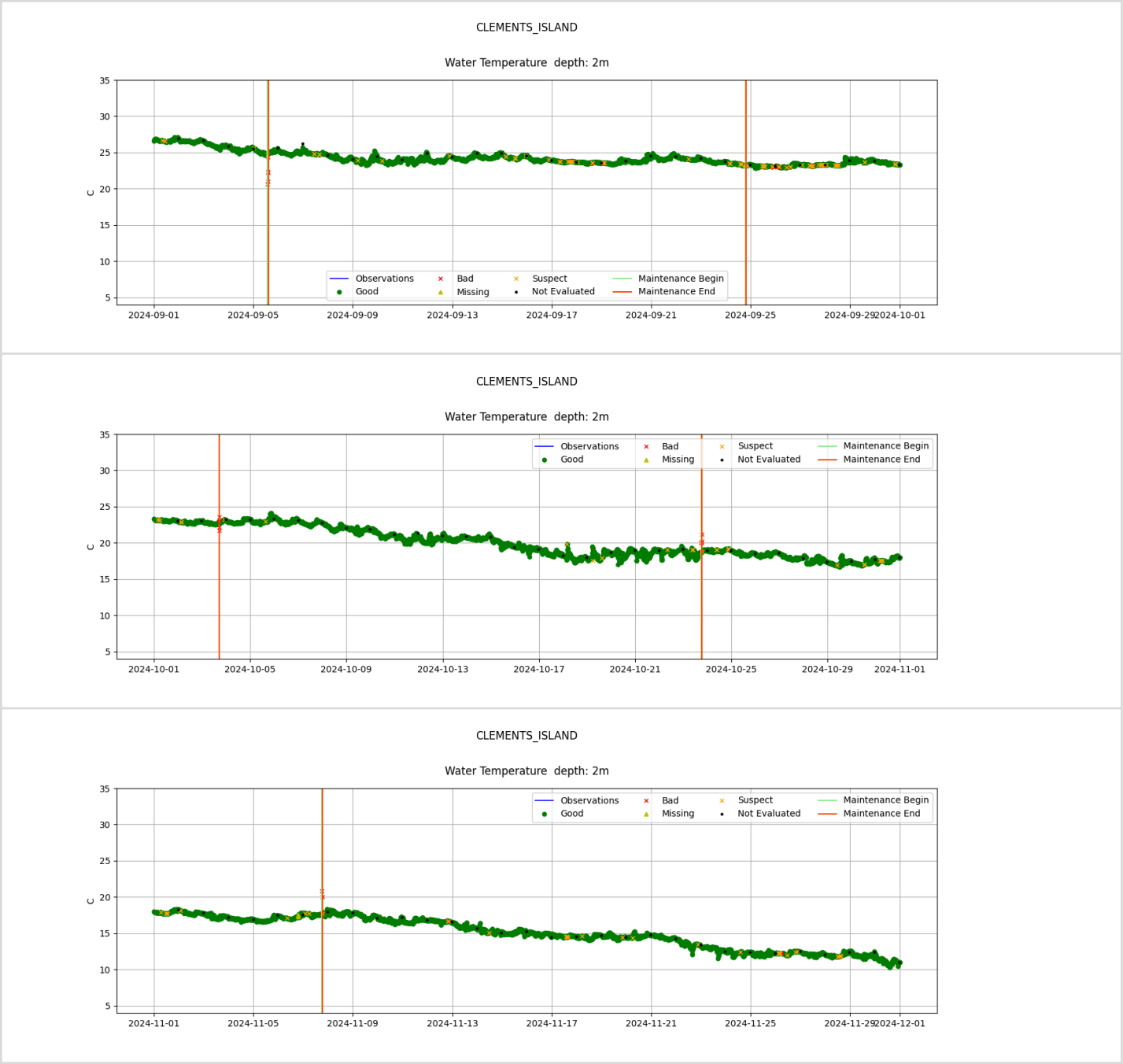


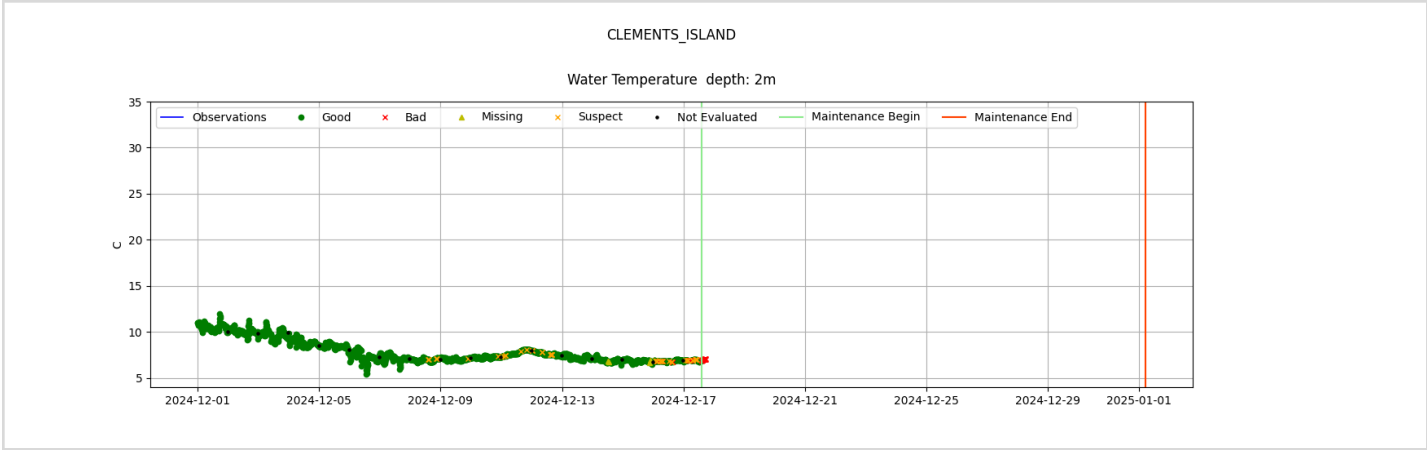




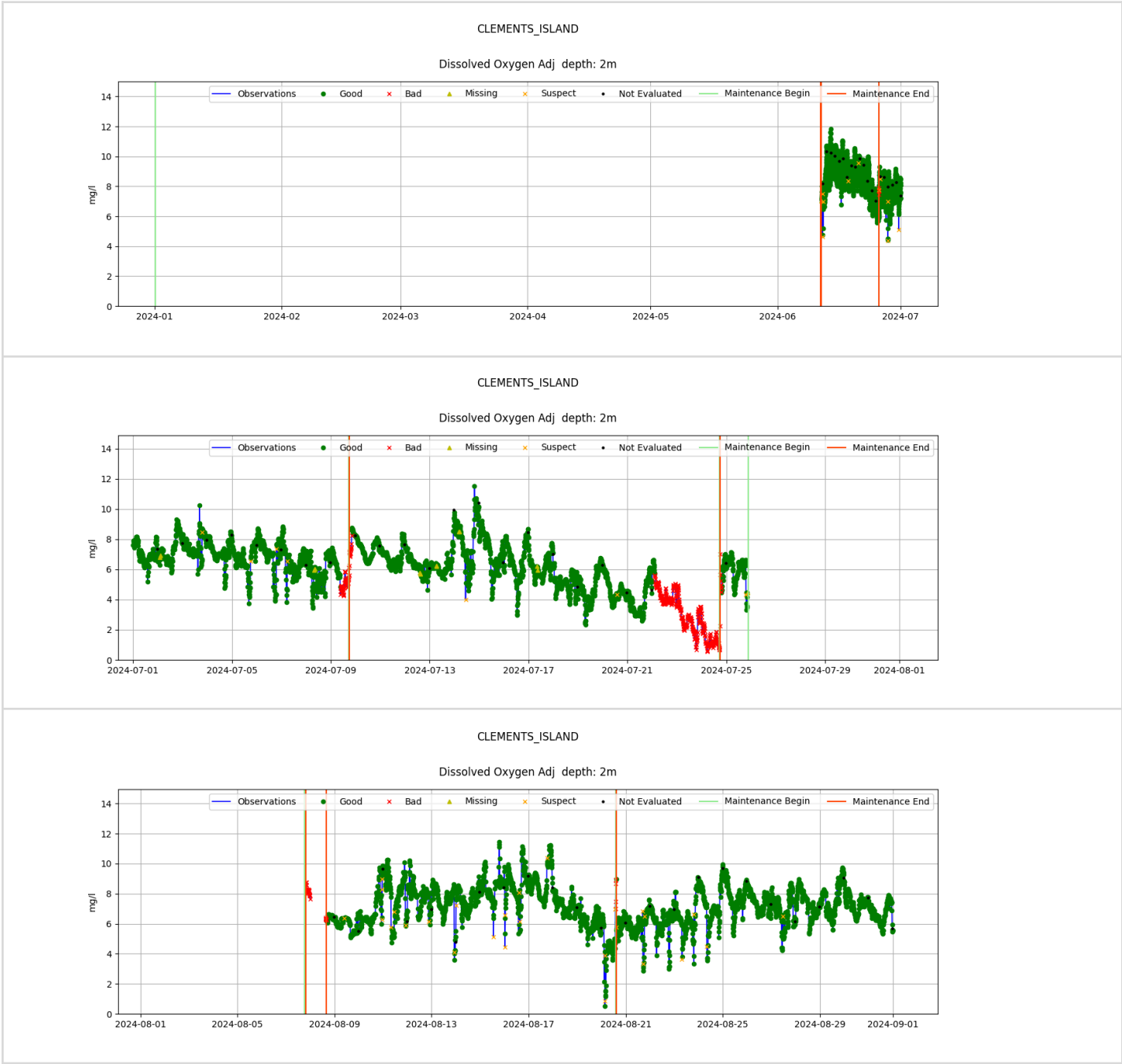
Clements Island 2m Water Temperature



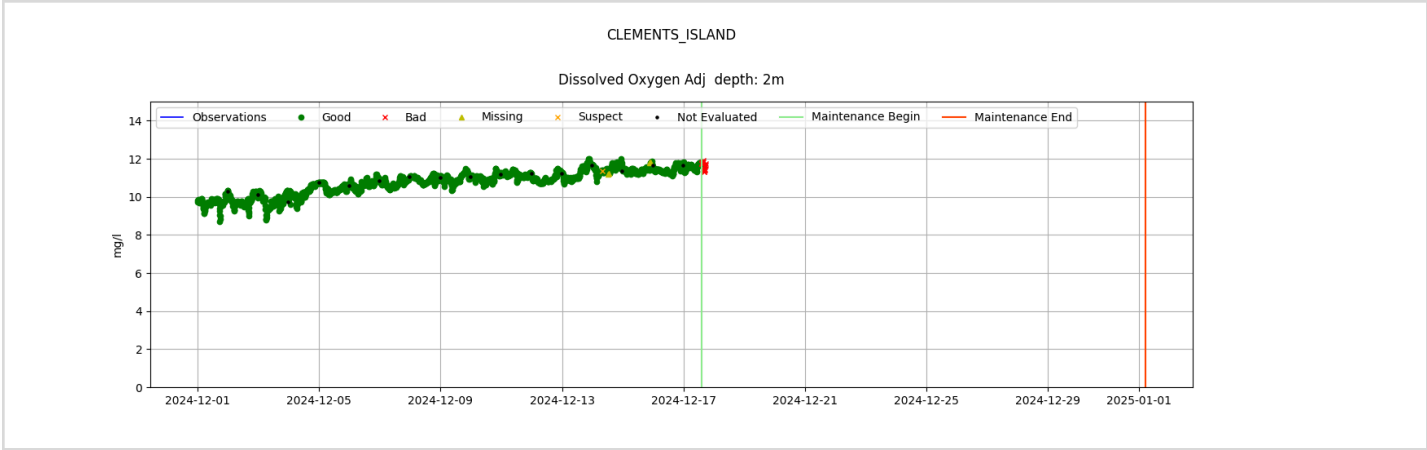




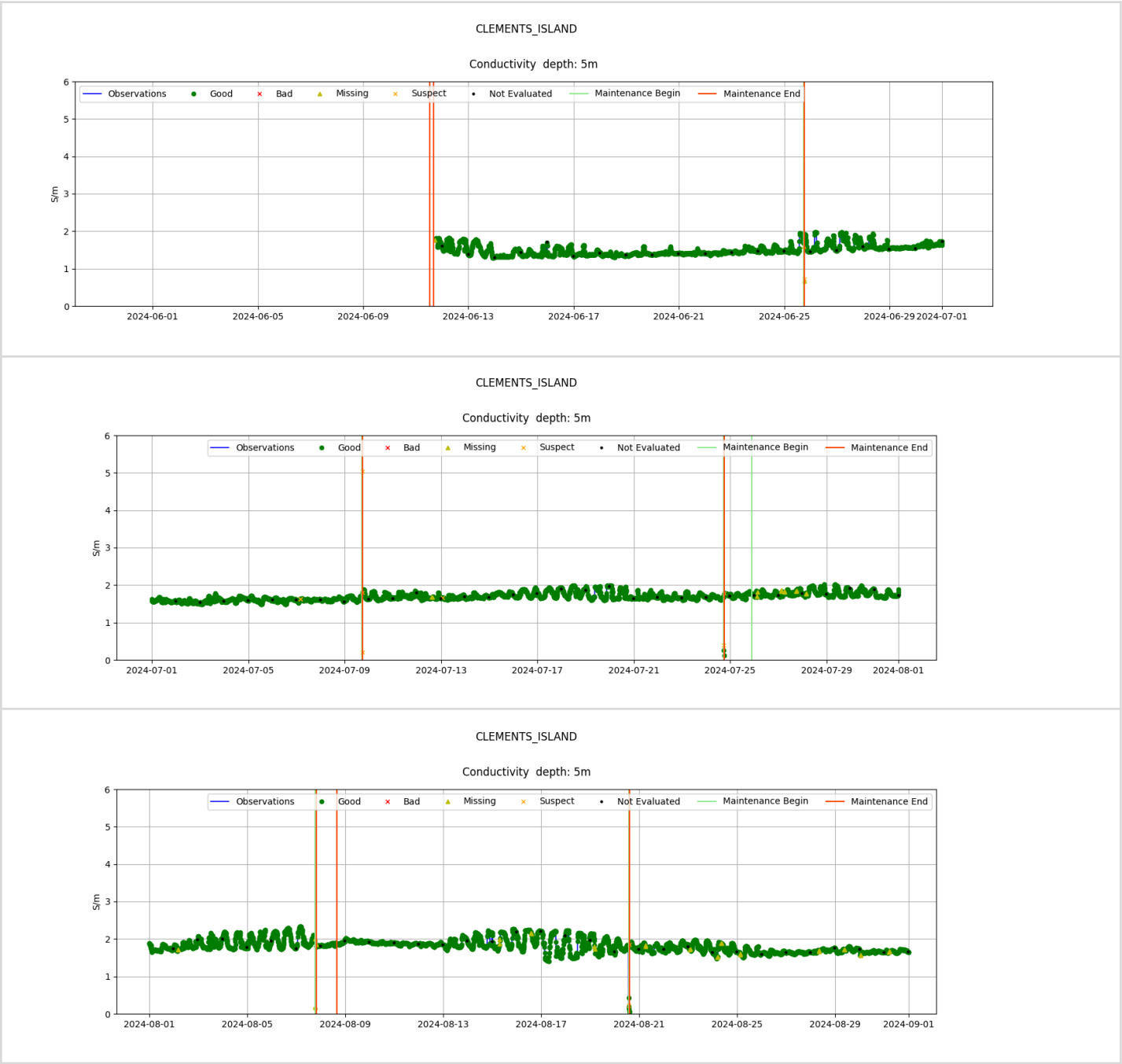
Clements Island 2m Dissolved Oxygen Adjusted



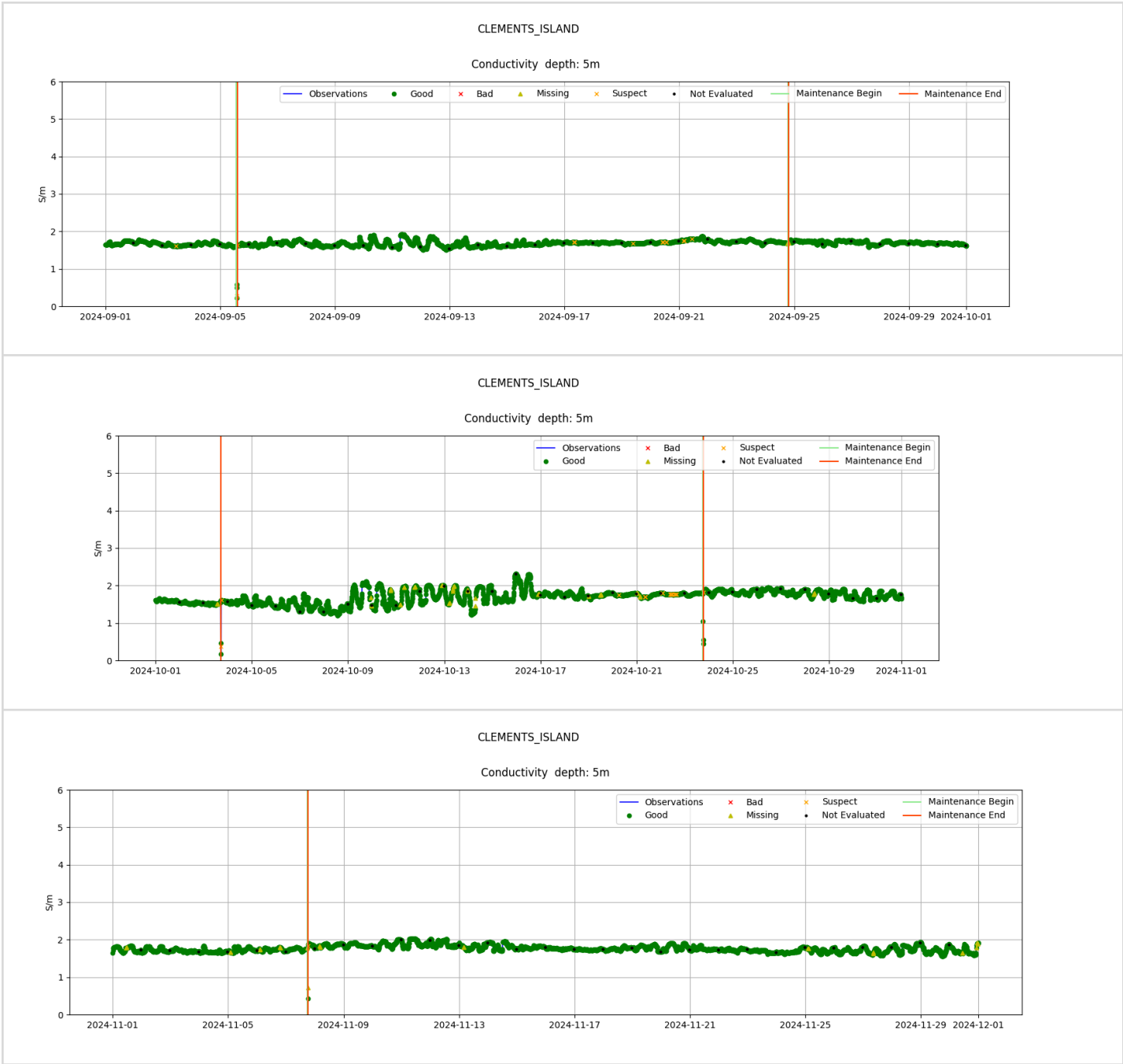


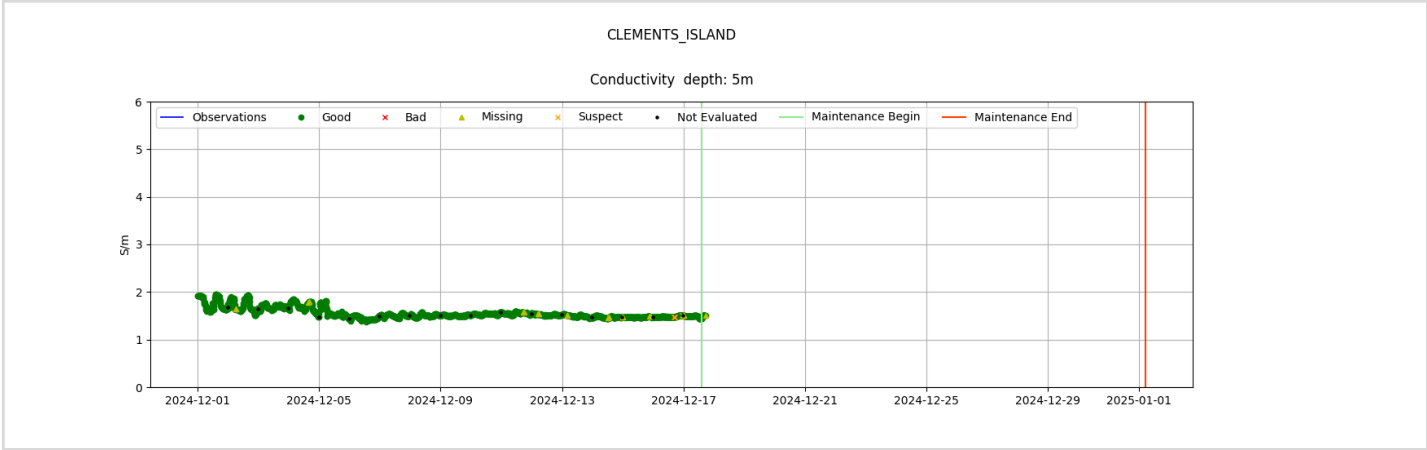


Clements Island 5m Conductivity



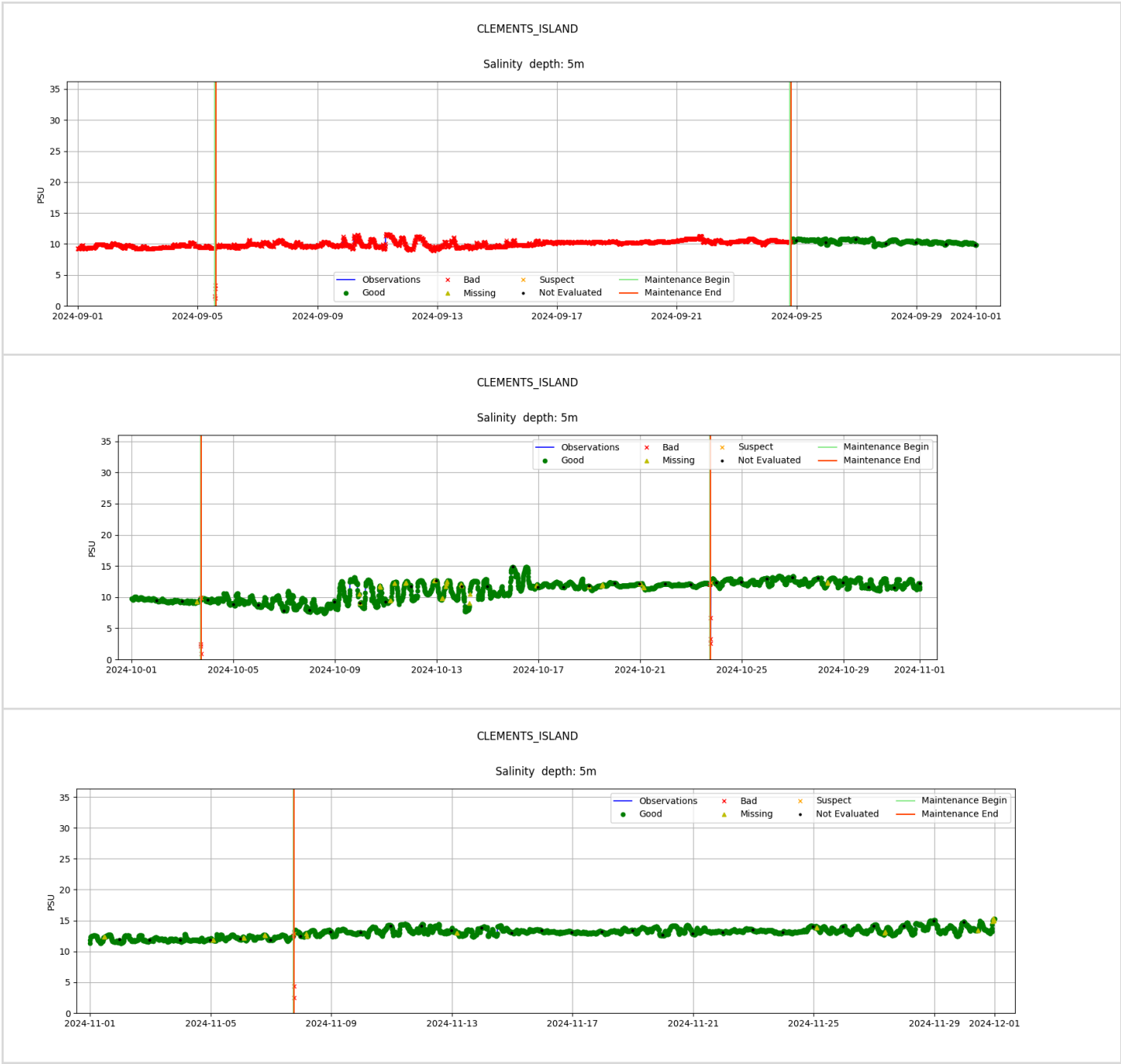


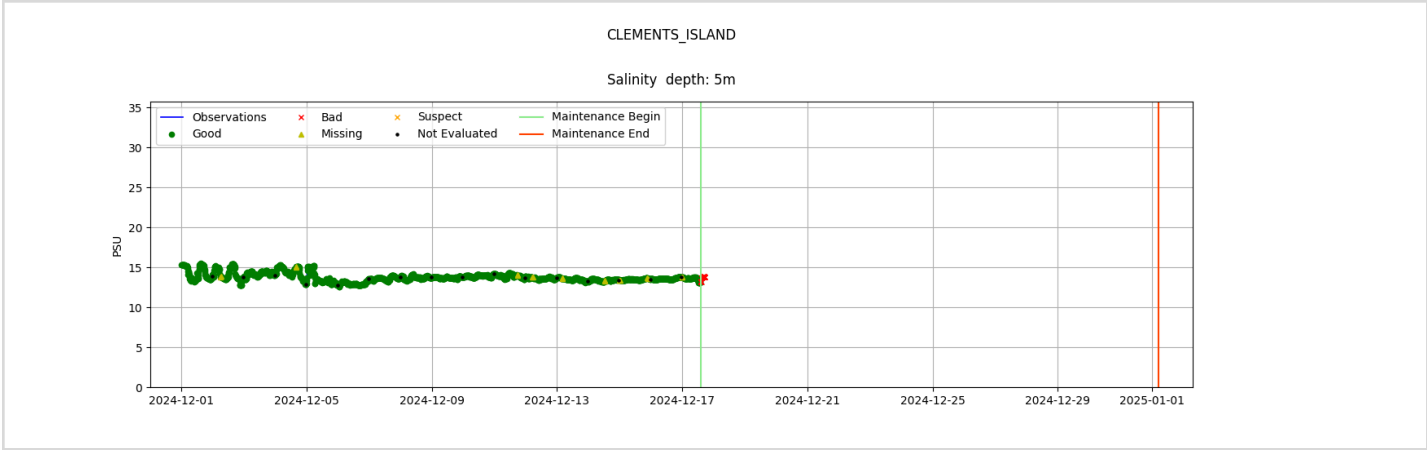




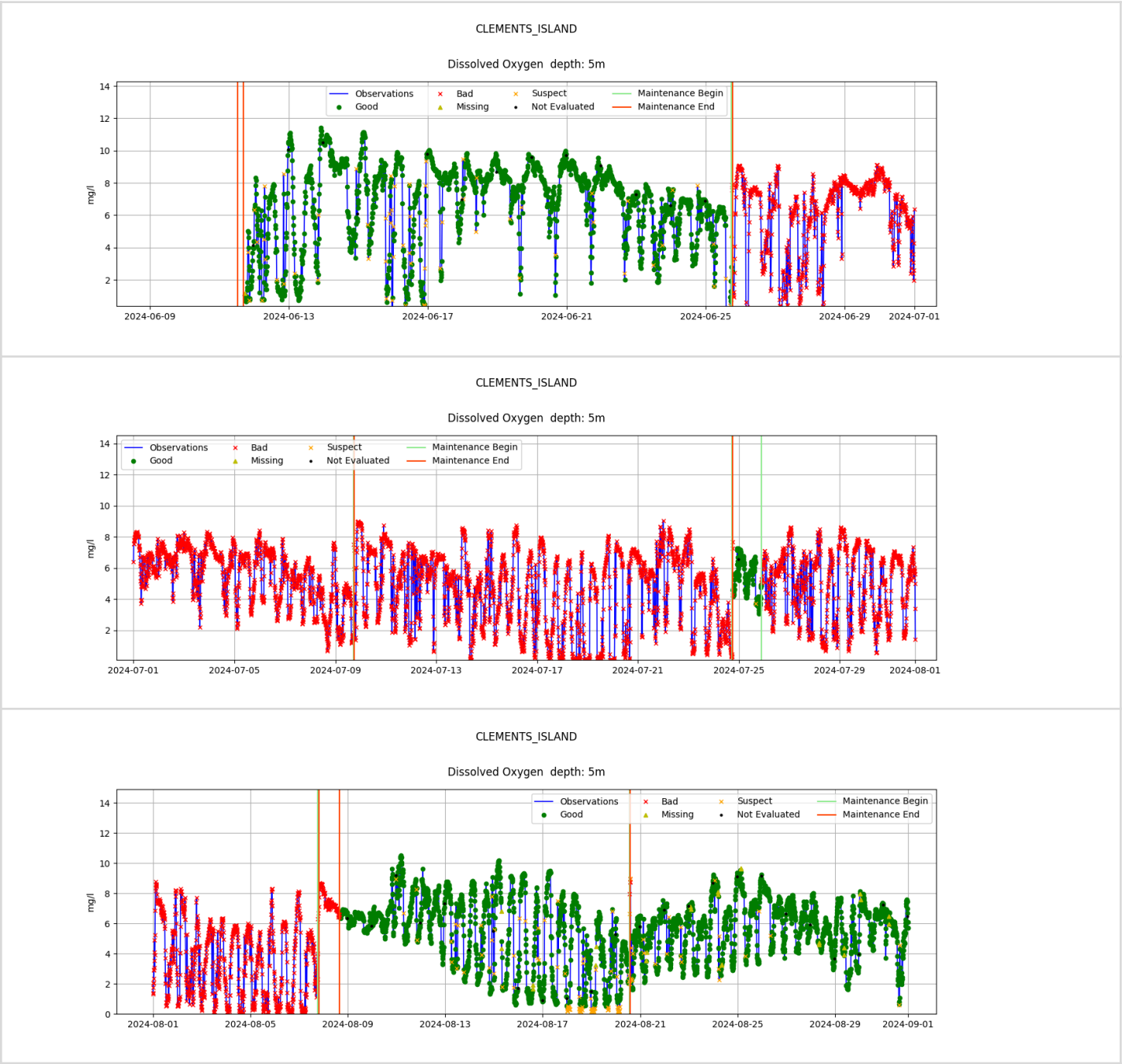
Clements Island 5m Salinity

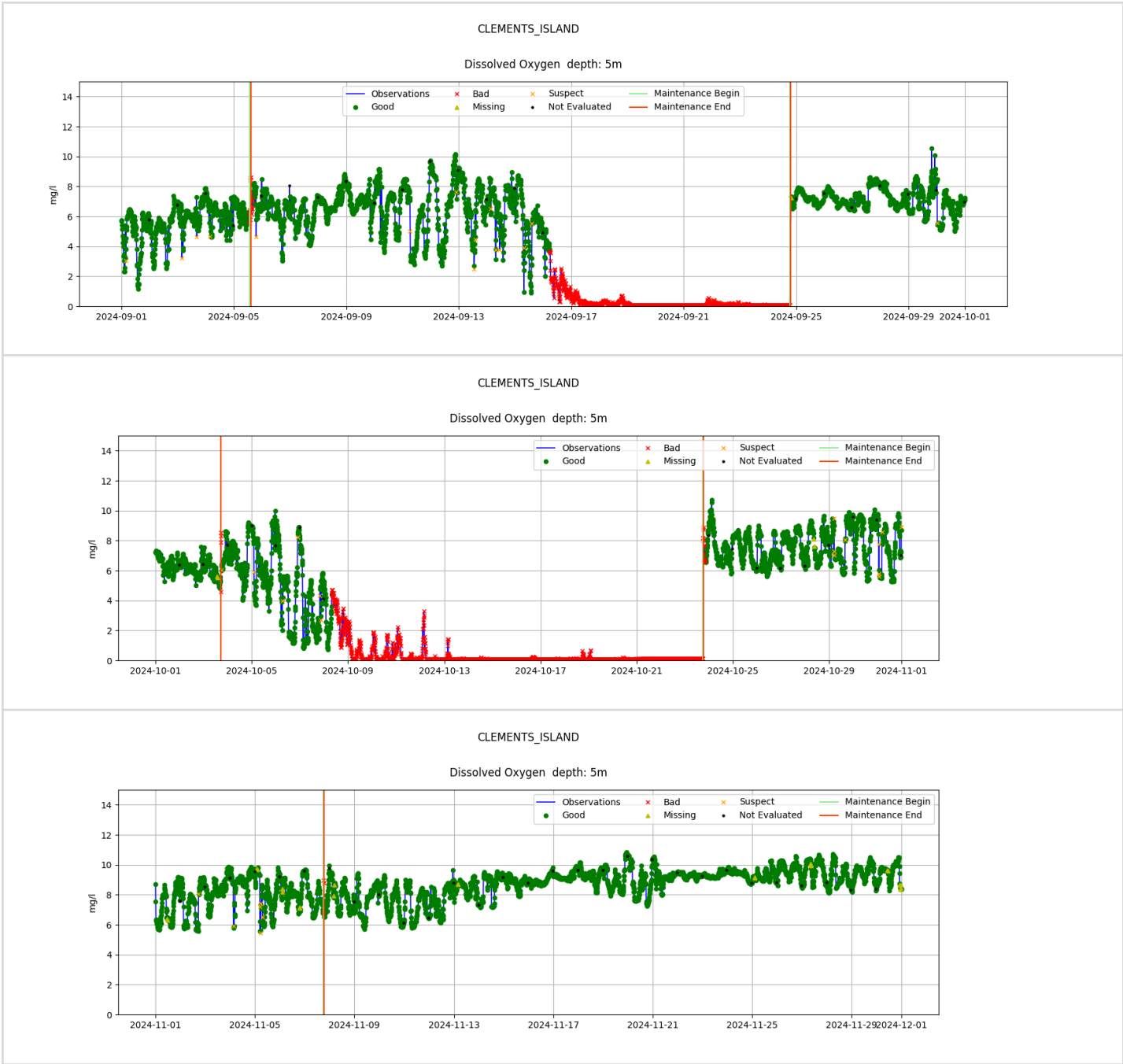


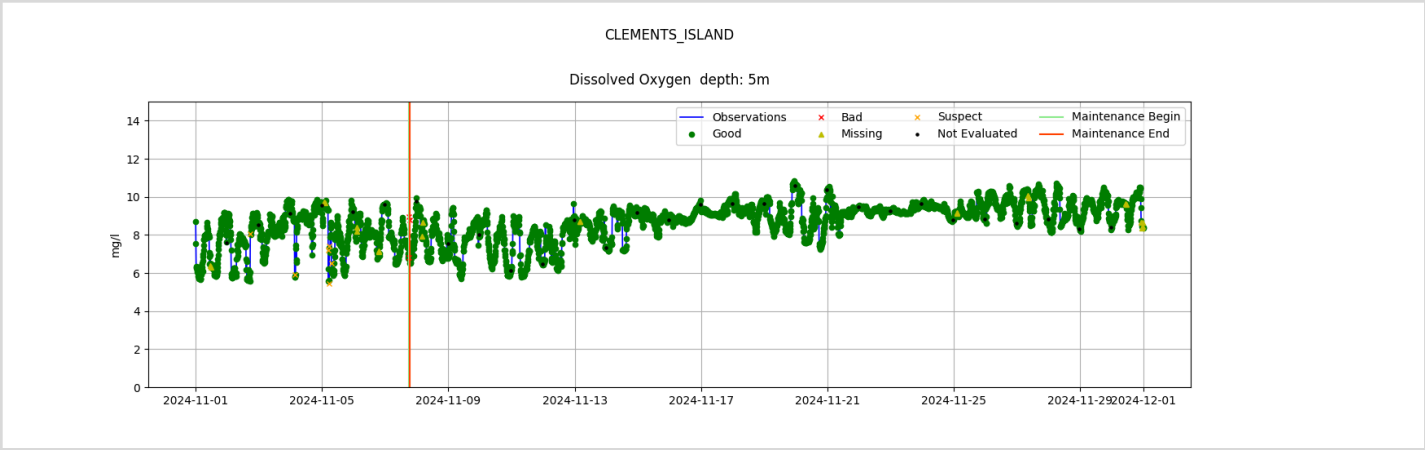




Clements Island 5m Dissolved Oxygen



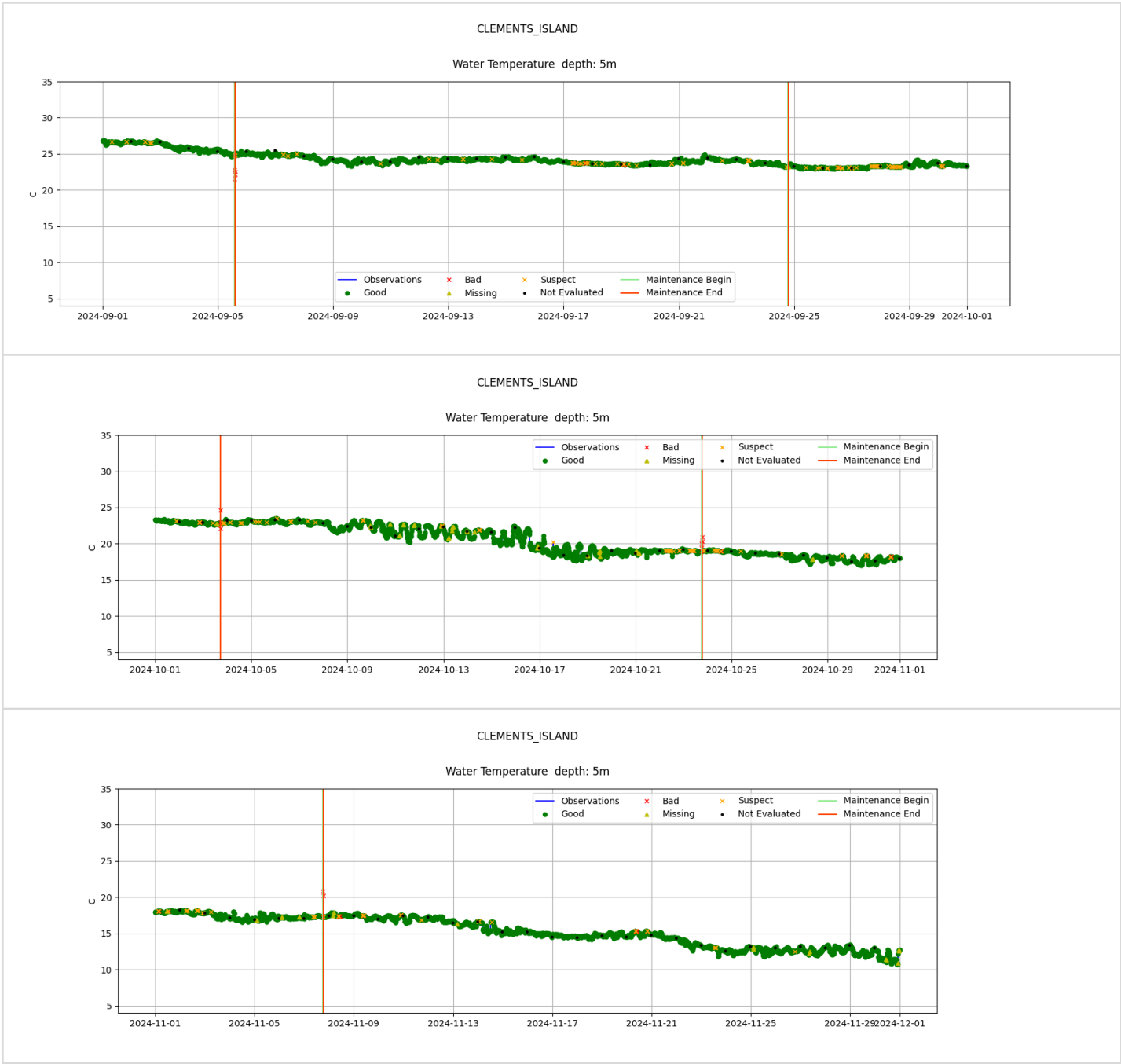


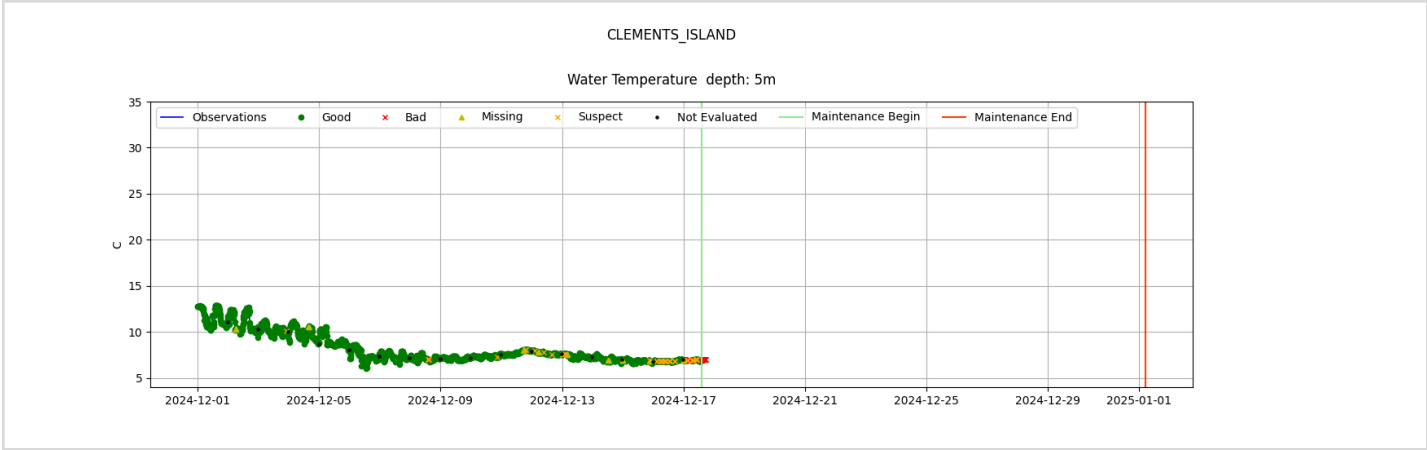




Clements Island 5m Water Temperature

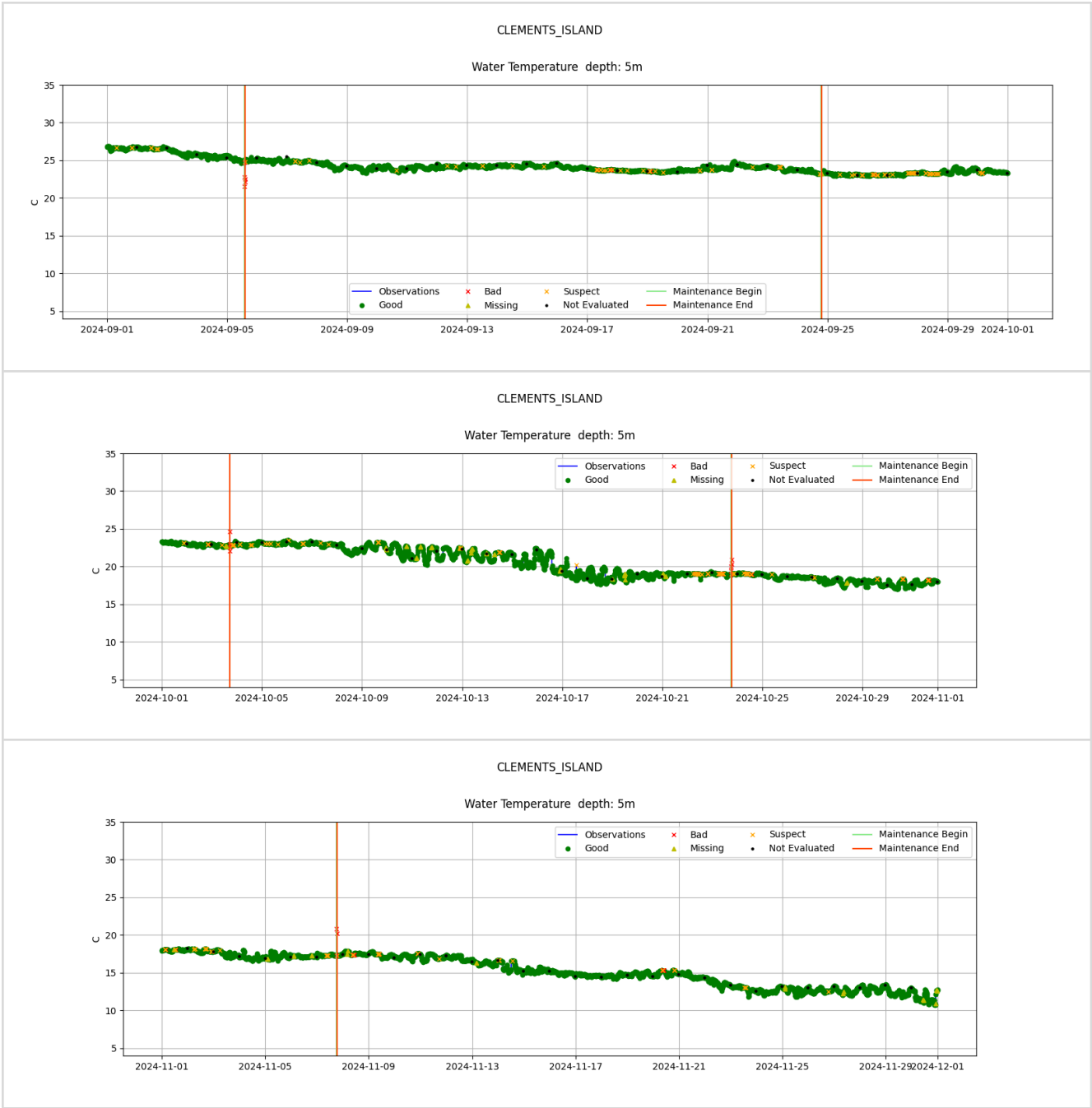


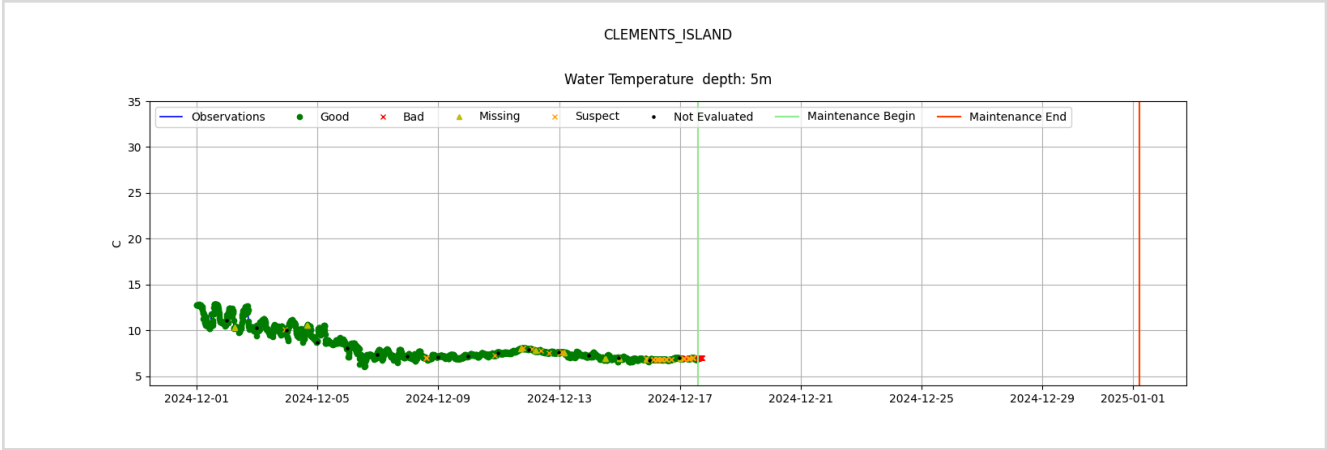




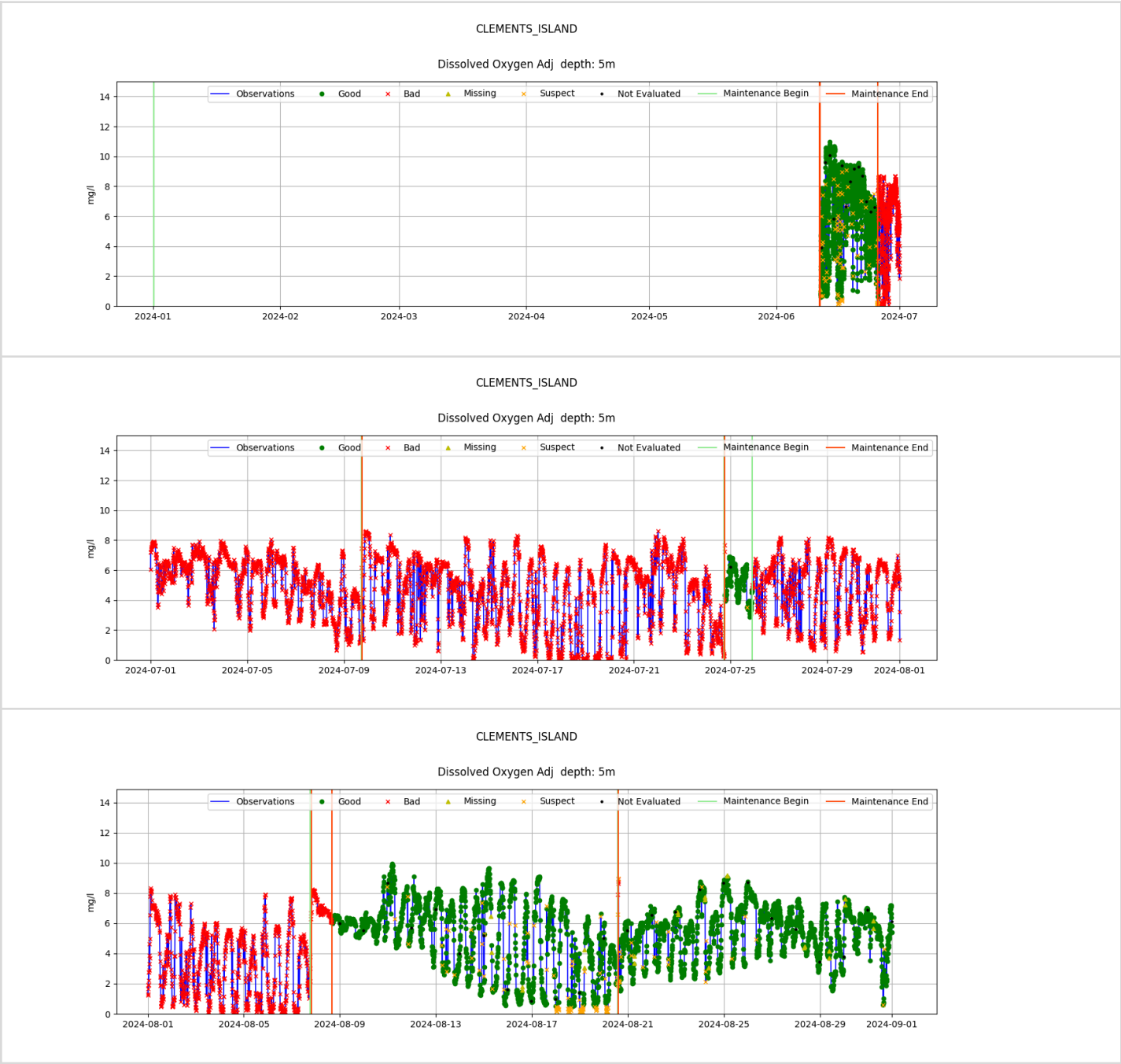
Clements Island 5m Water Temperature

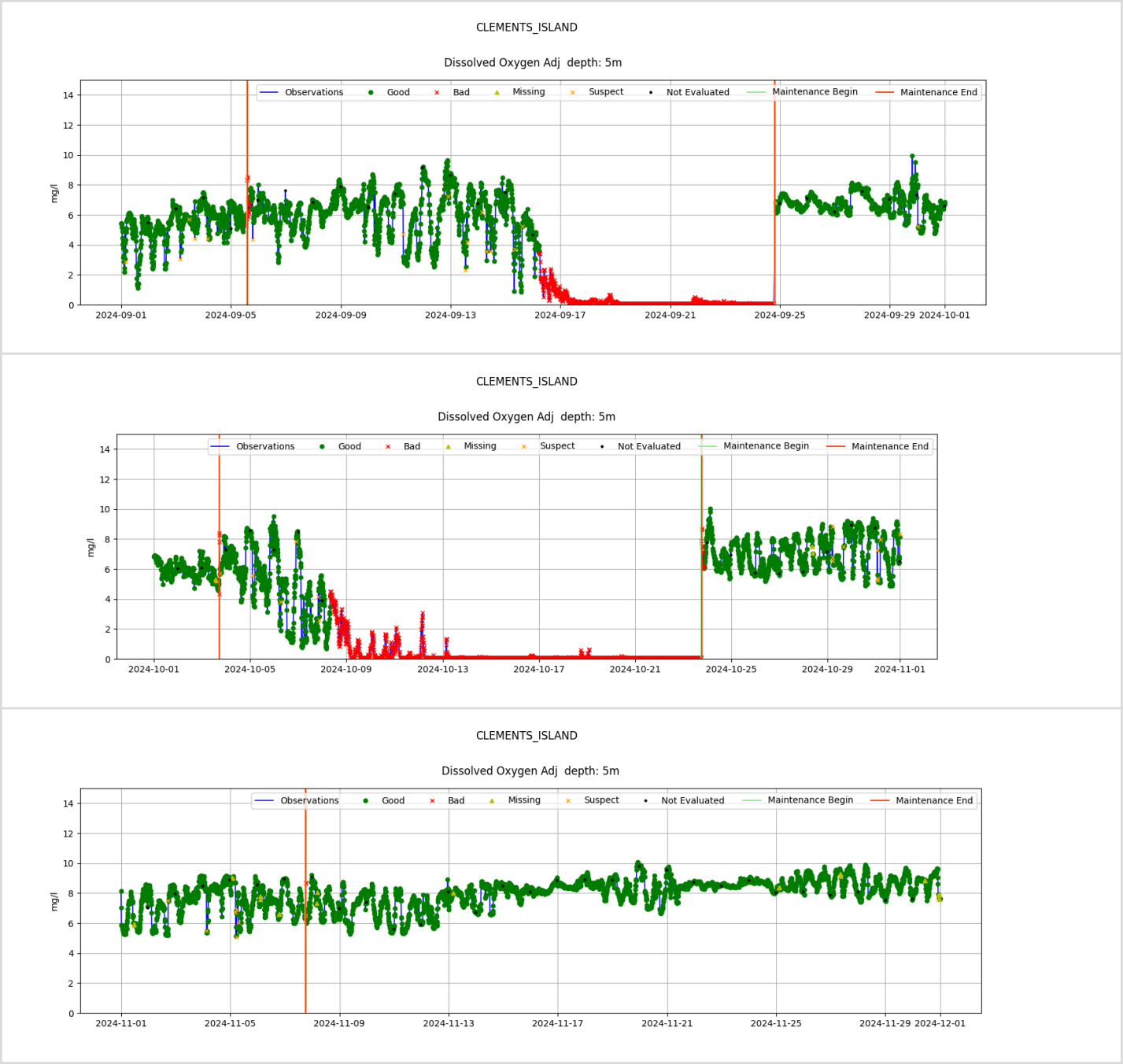




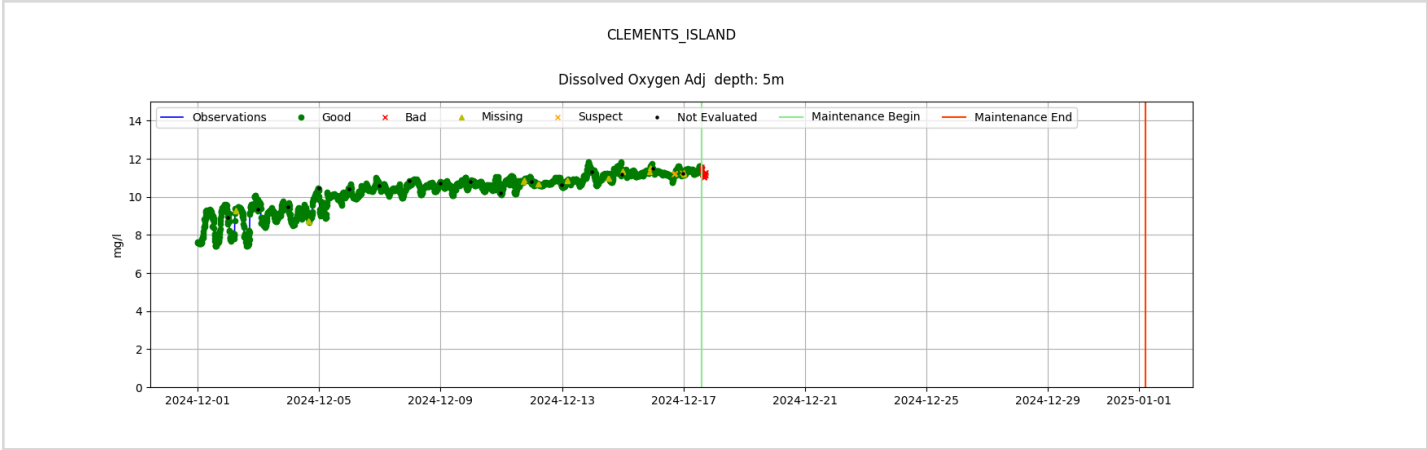


Clements Island 5m Dissolved Oxygen Adjusted

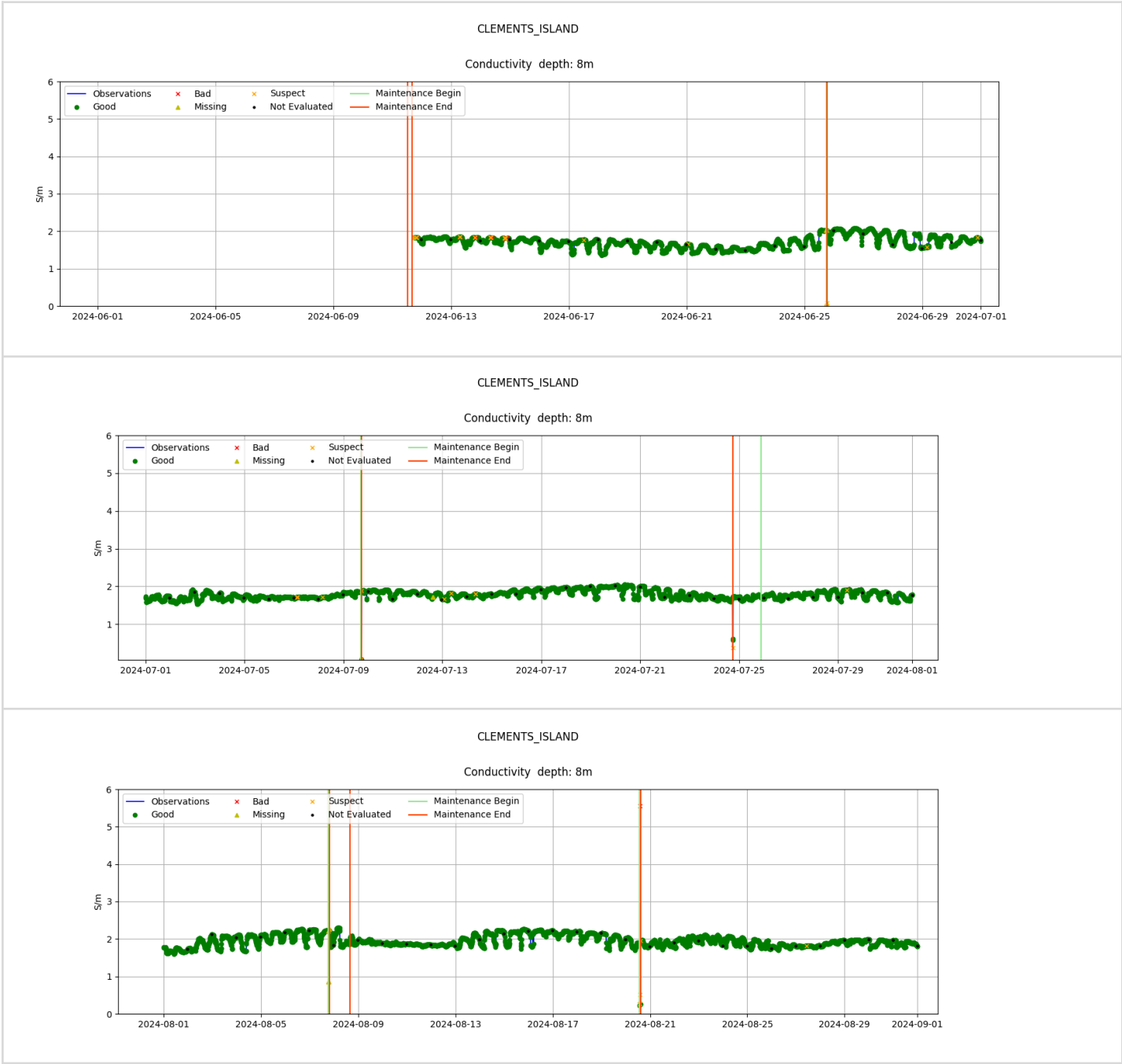


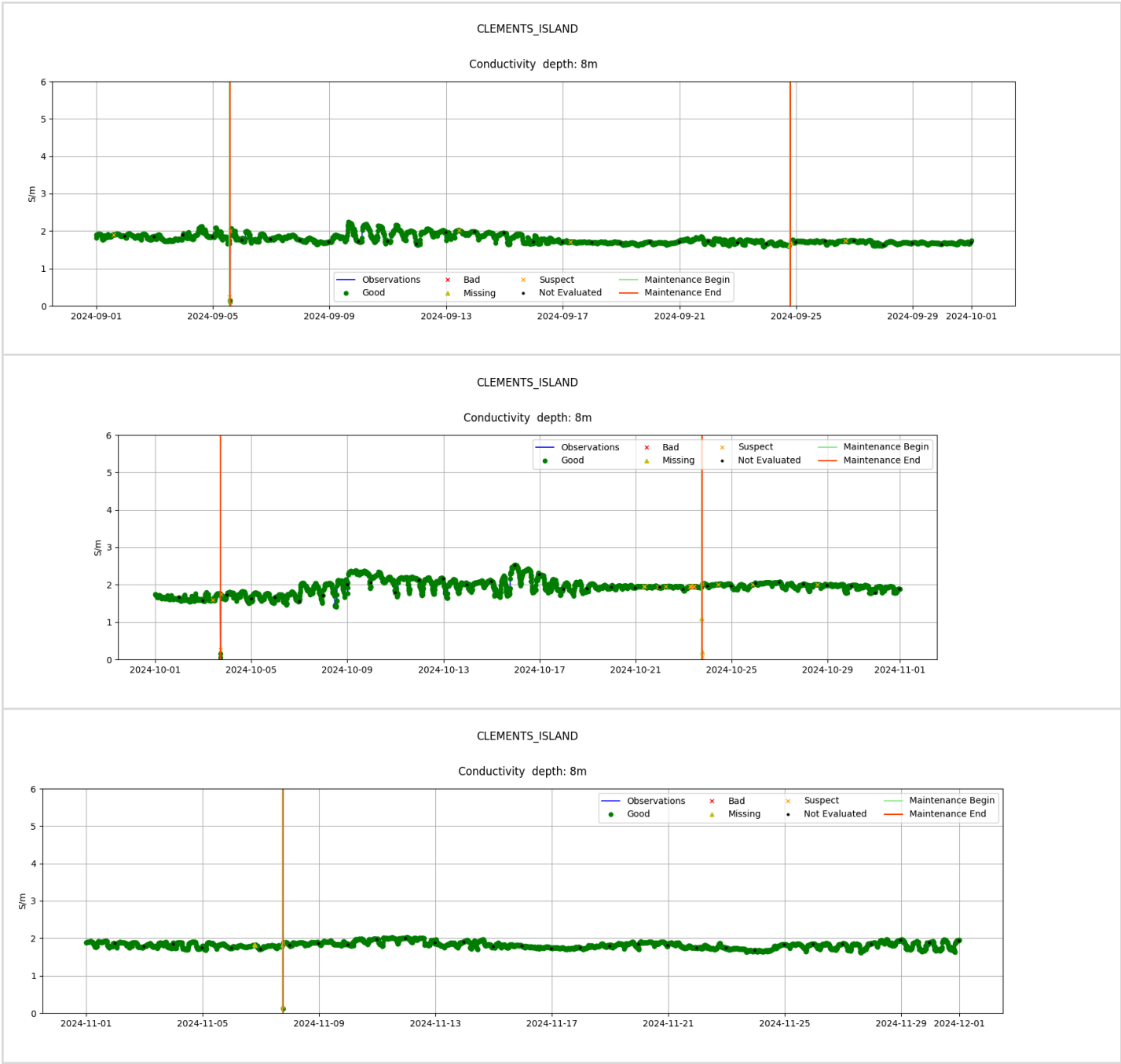


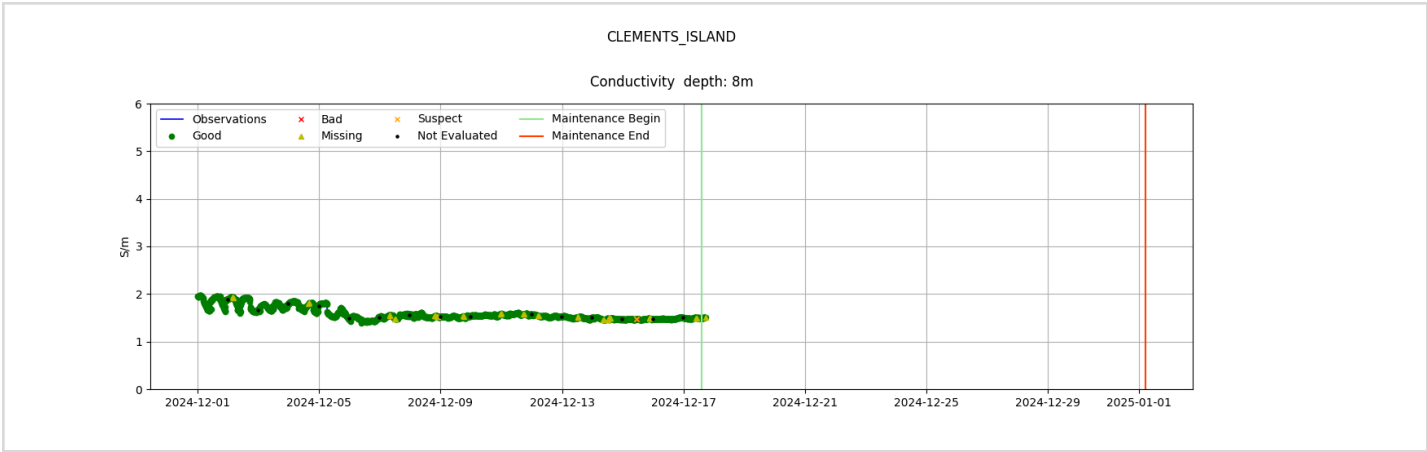




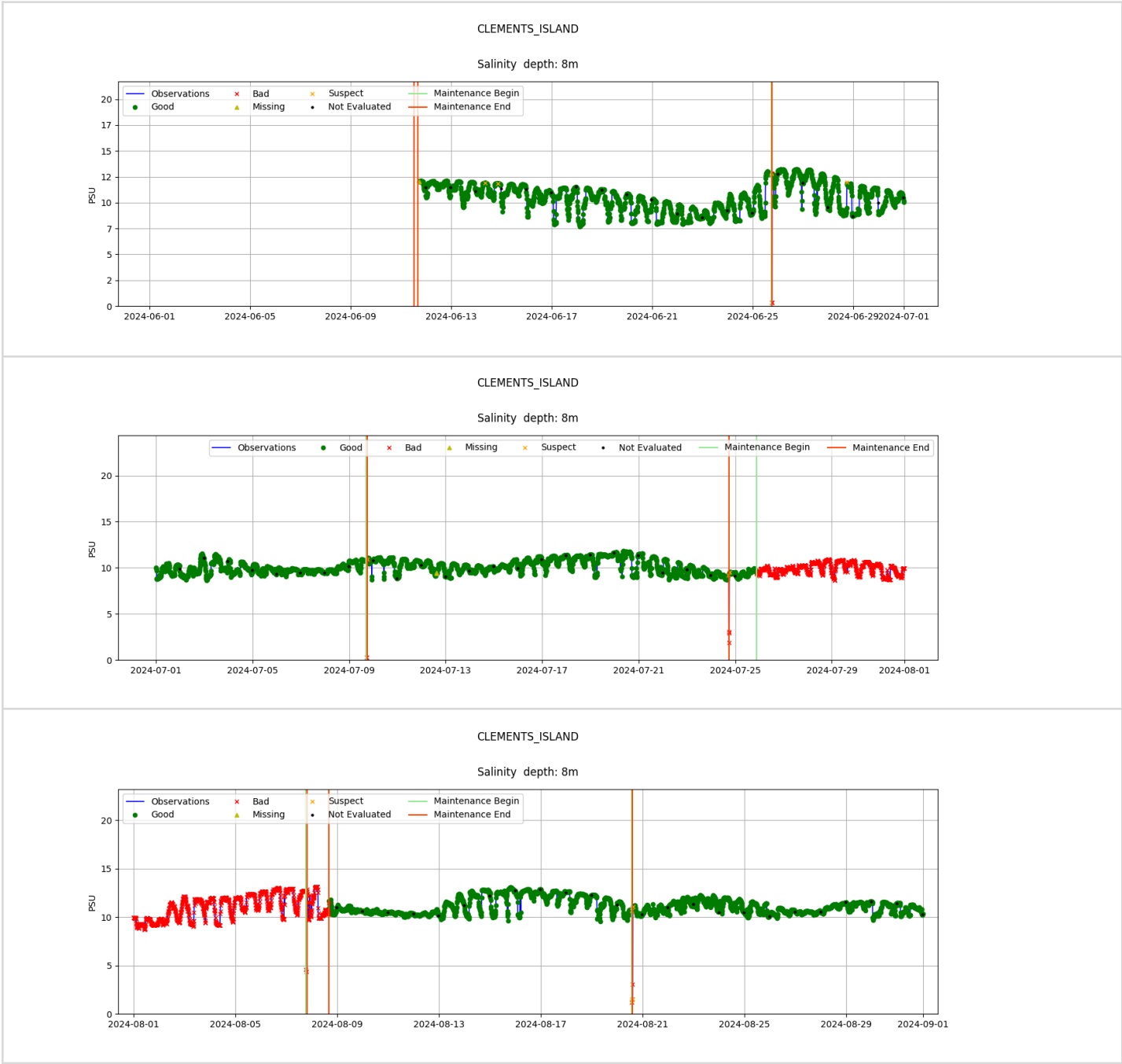
Clements Island 8m Conductivity

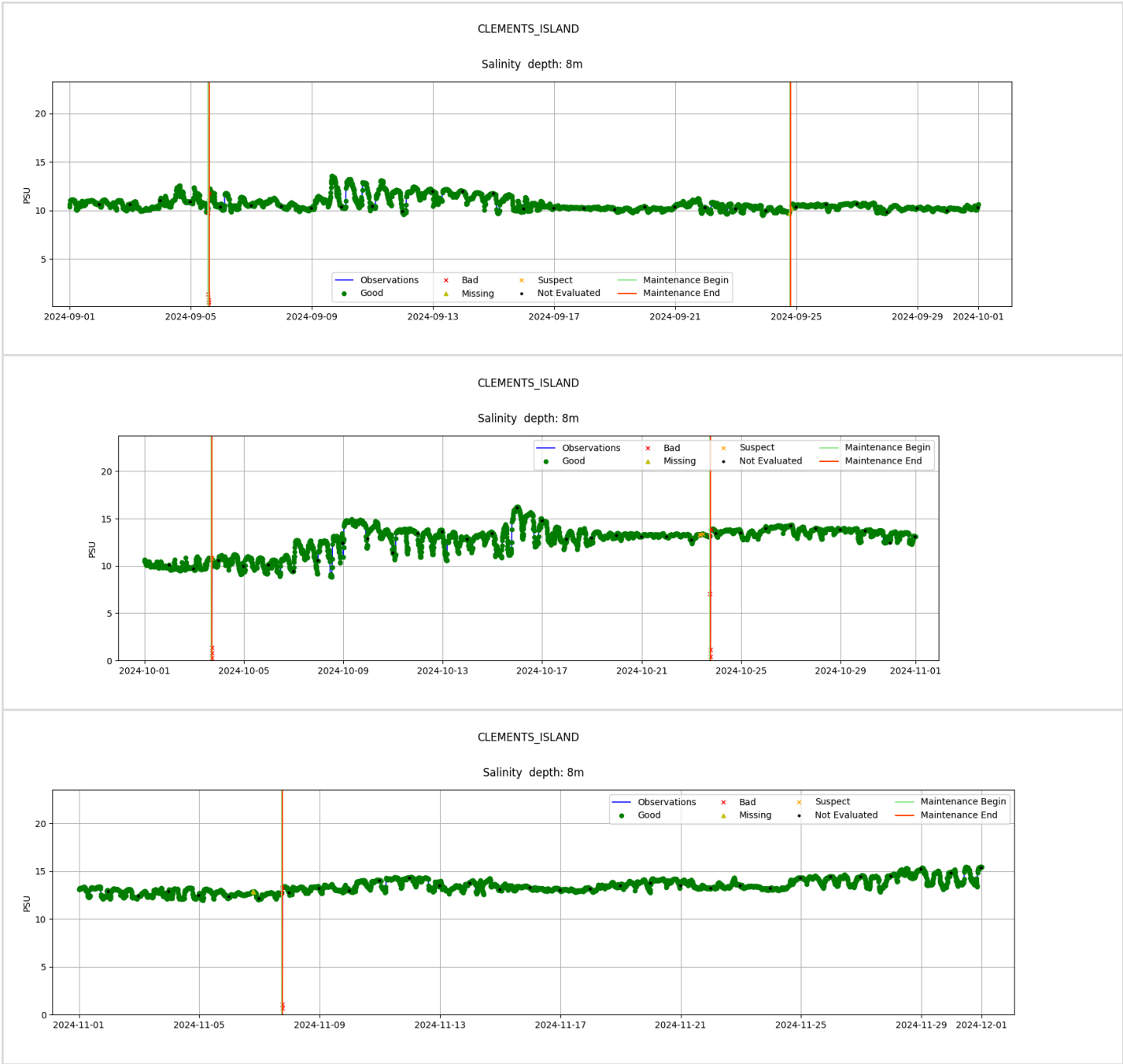


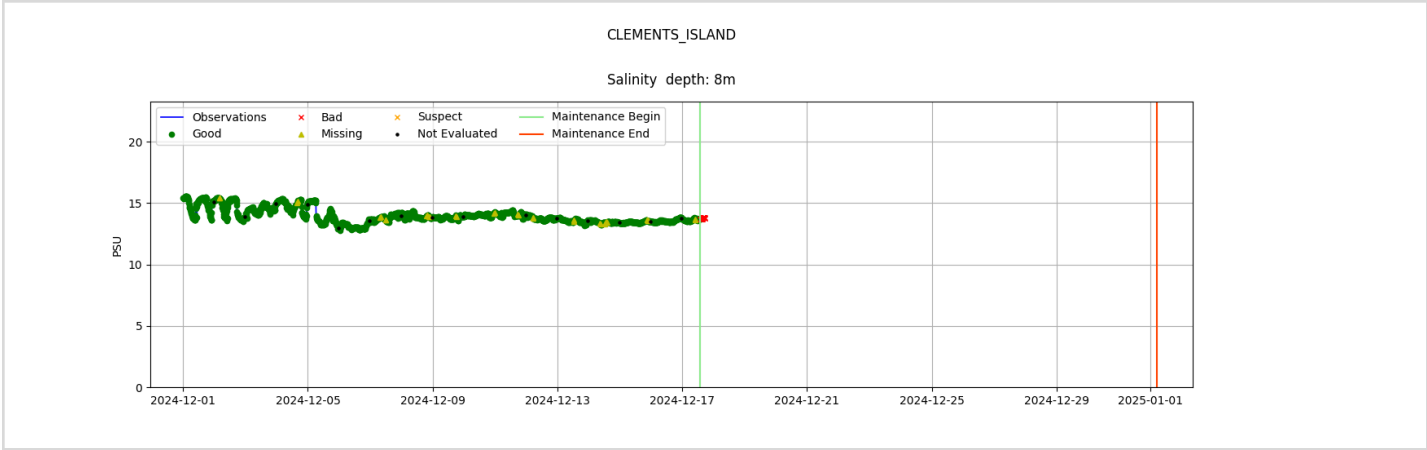




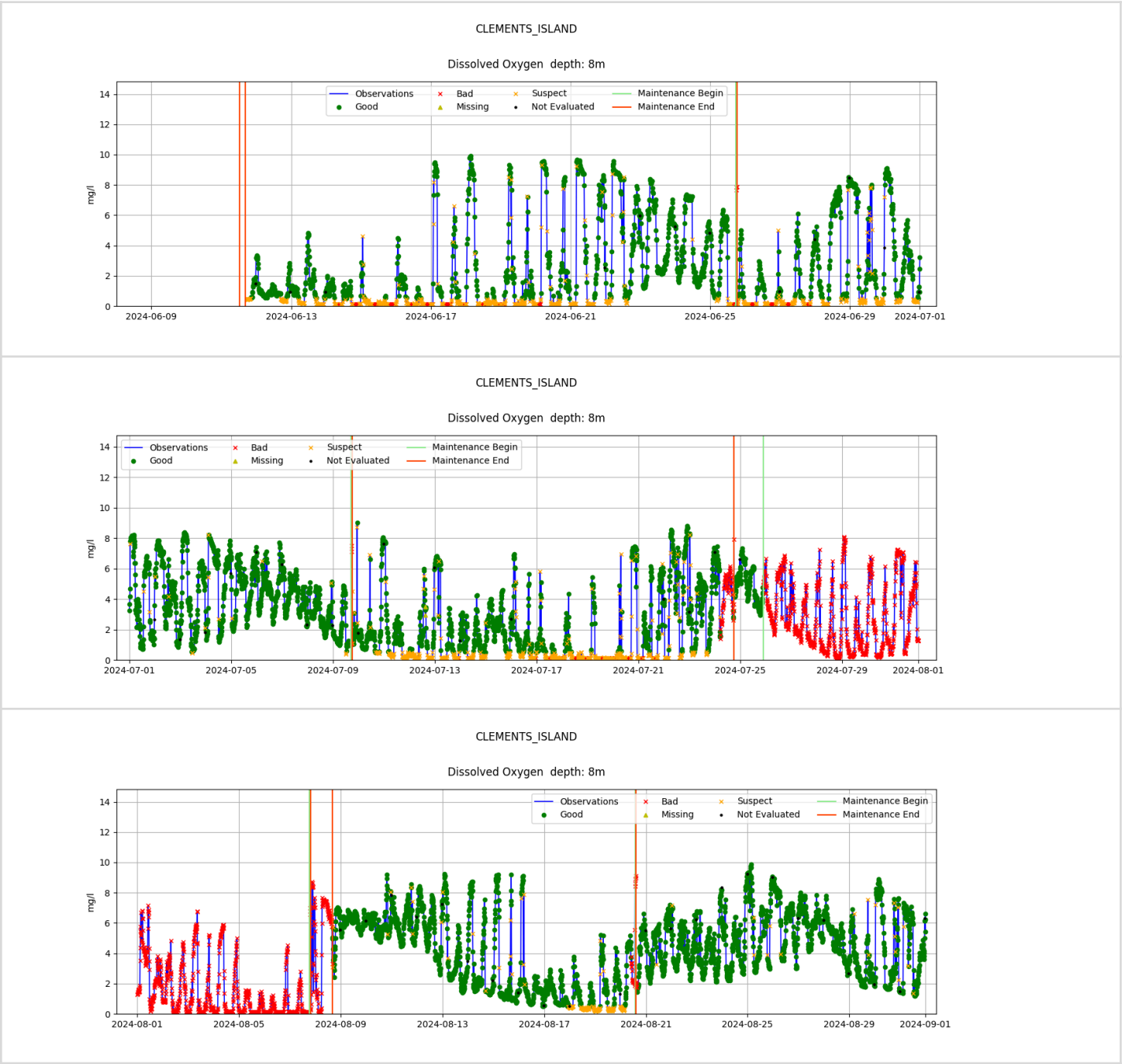
Clements Island 8m Salinity



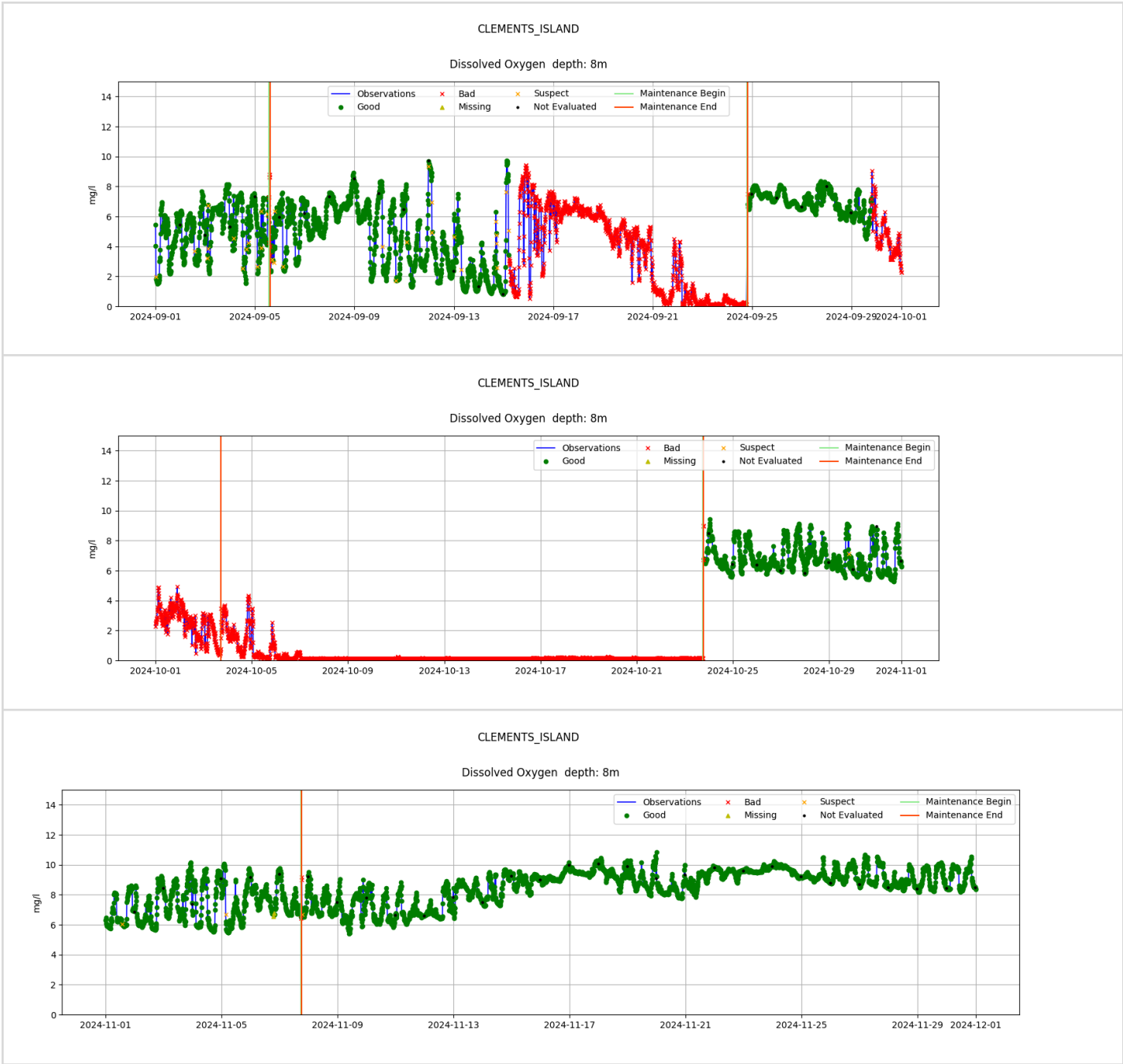


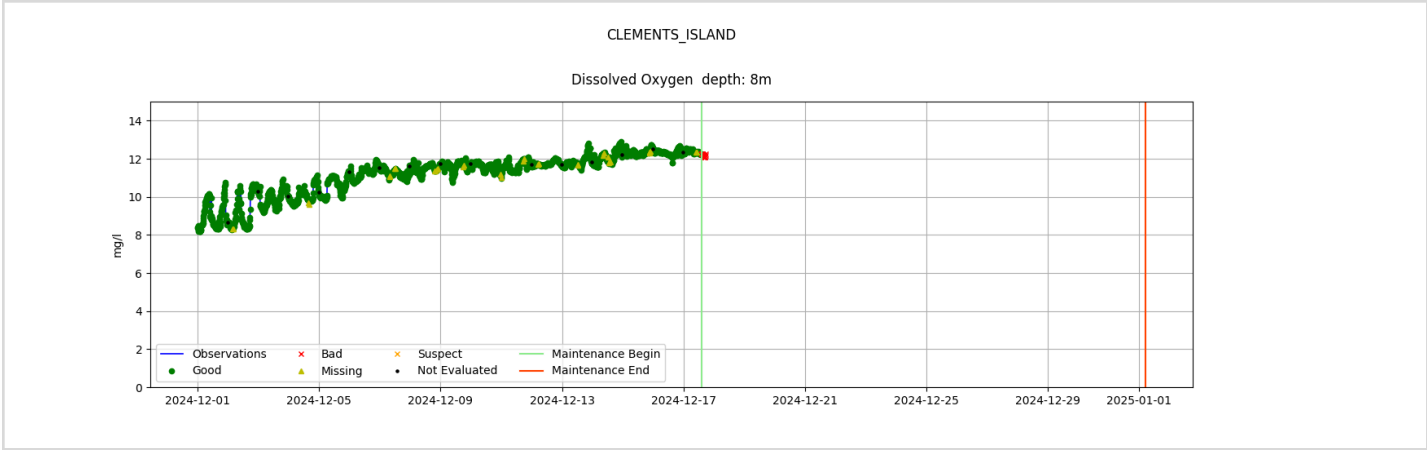


Clements Island 8m Dissolved Oxygen



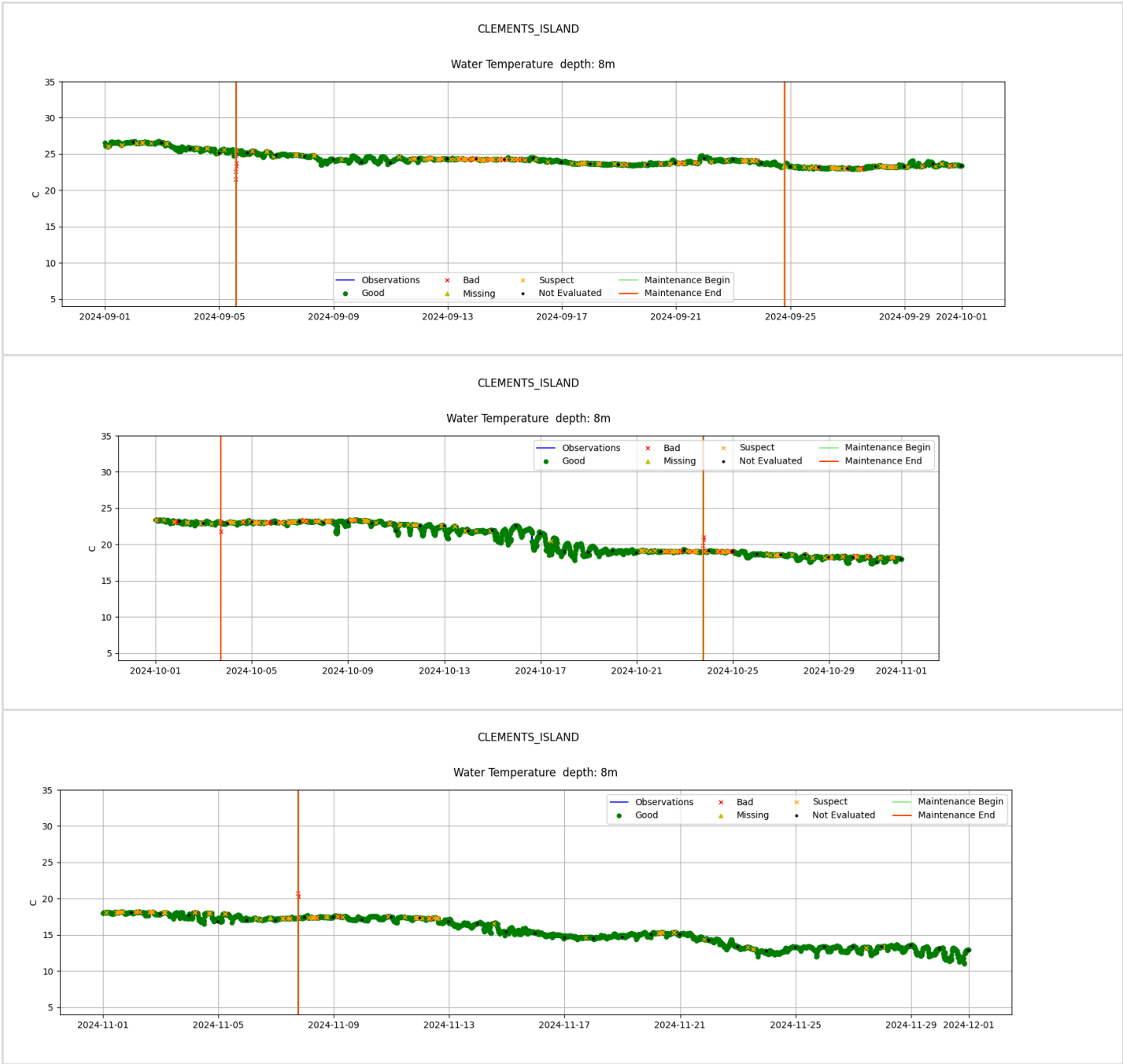


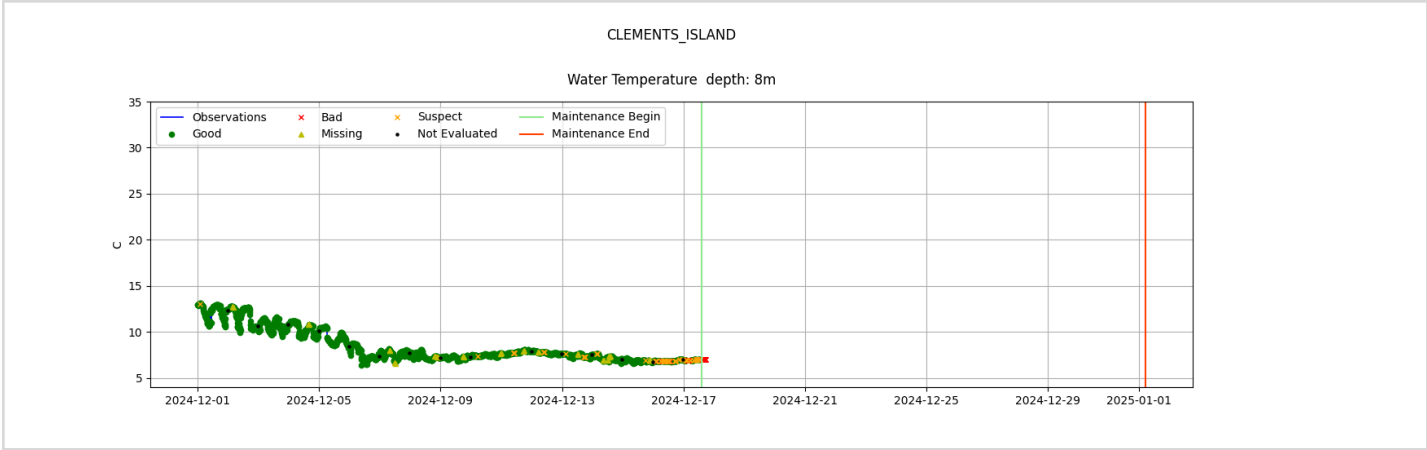




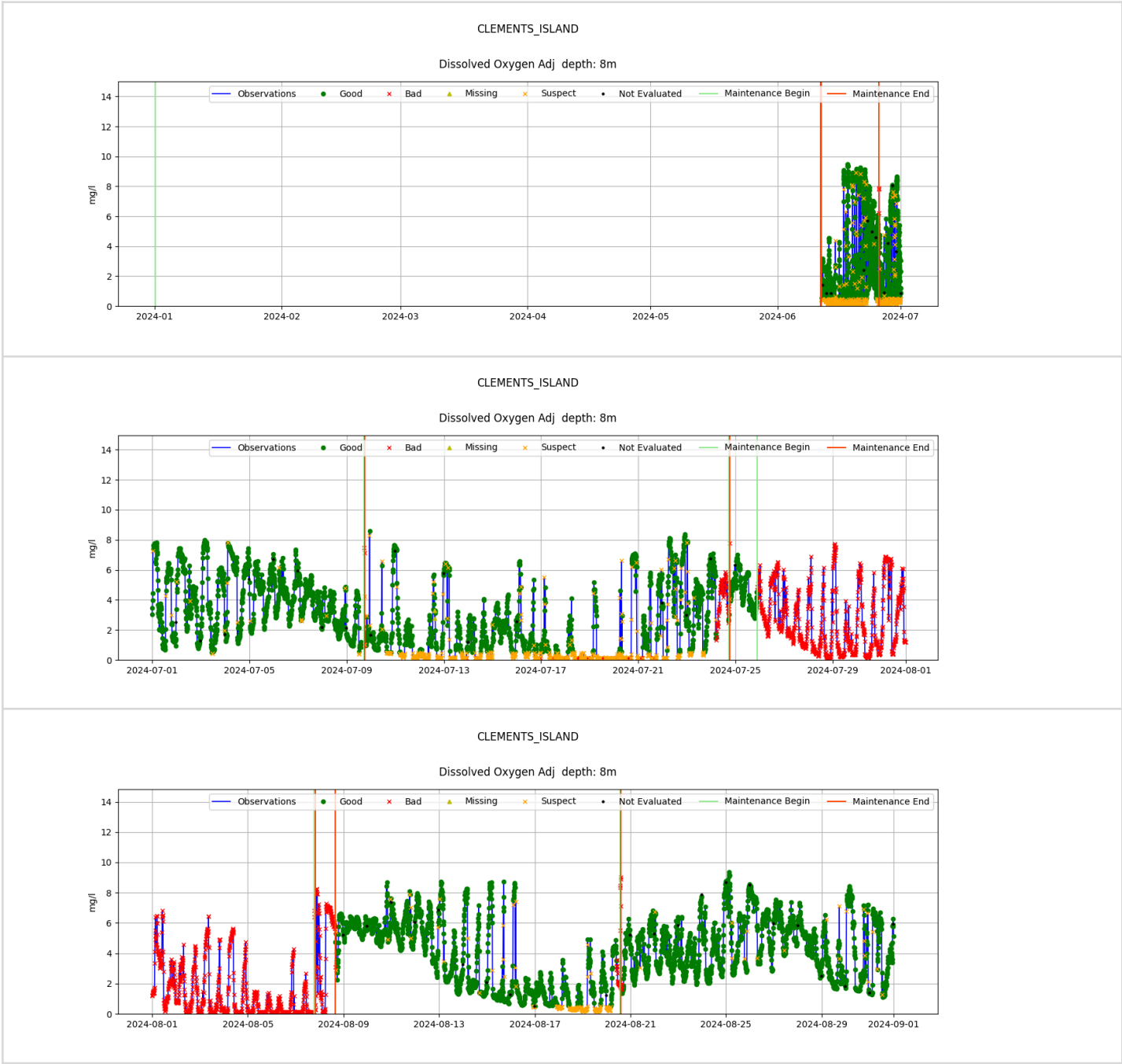
Clements Island 8m Water Temperature

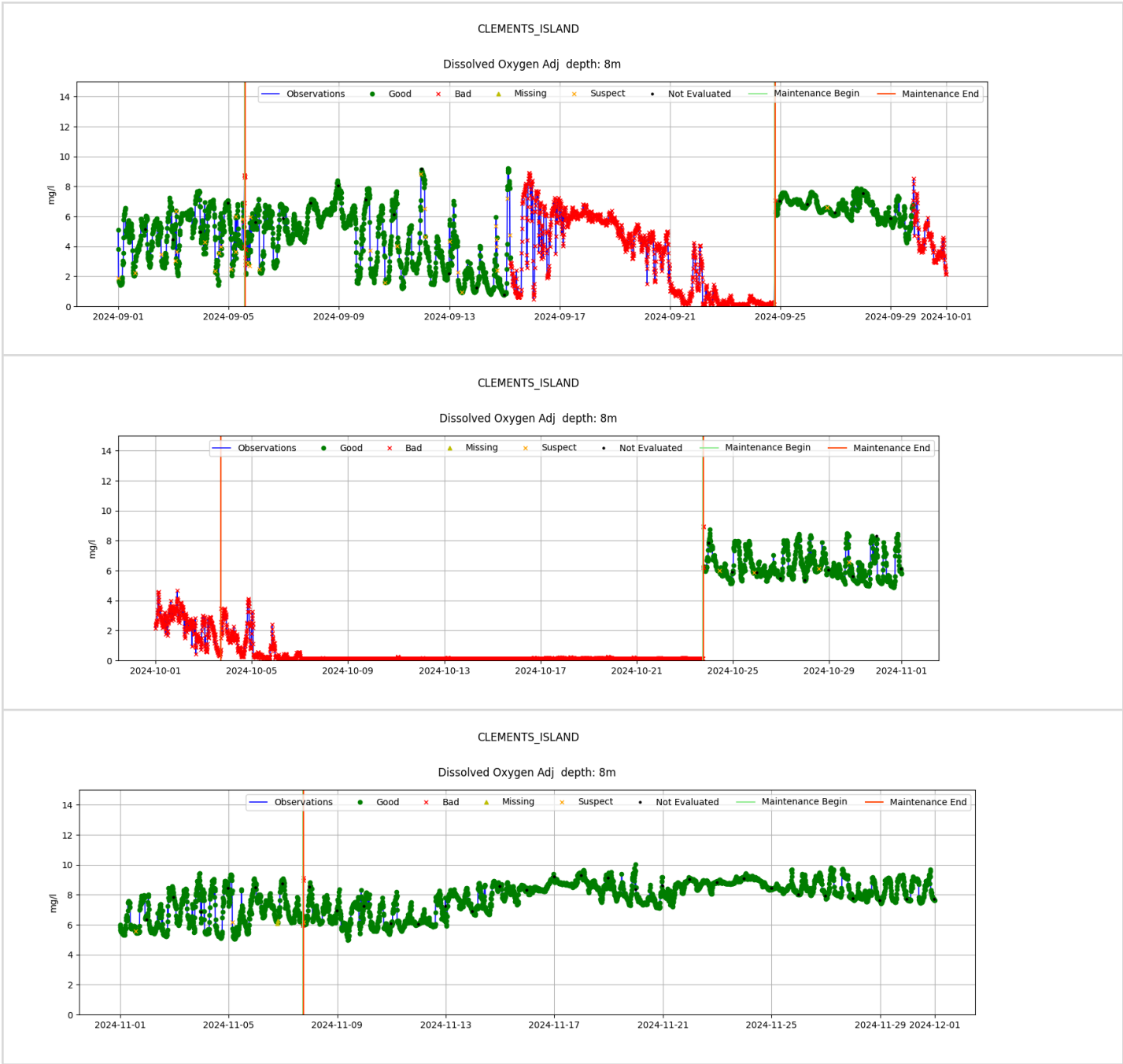


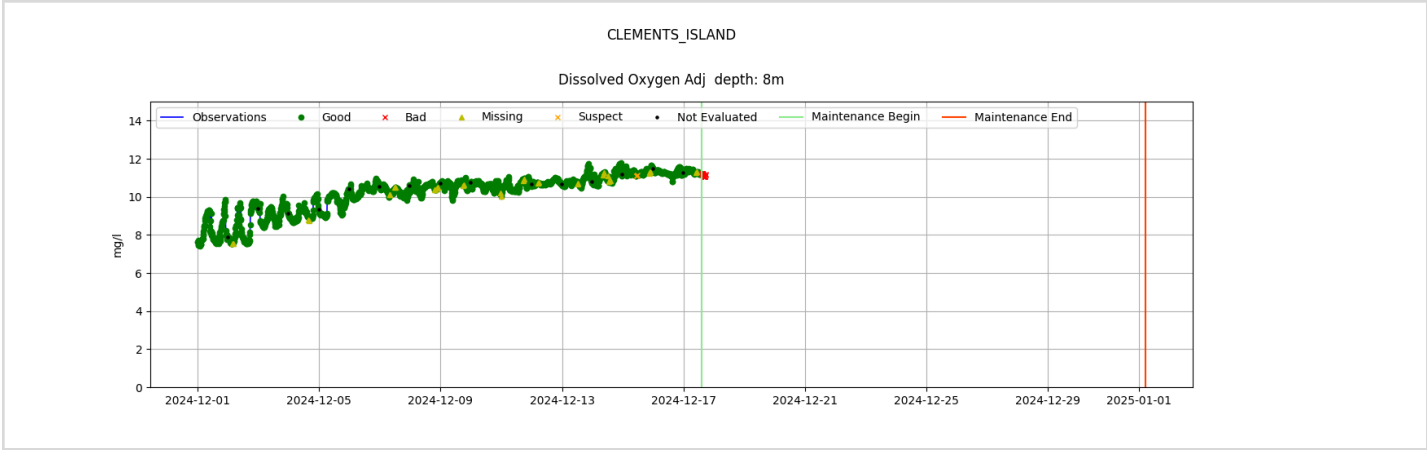




Clements Island 8m Dissolved Oxygen Adjusted

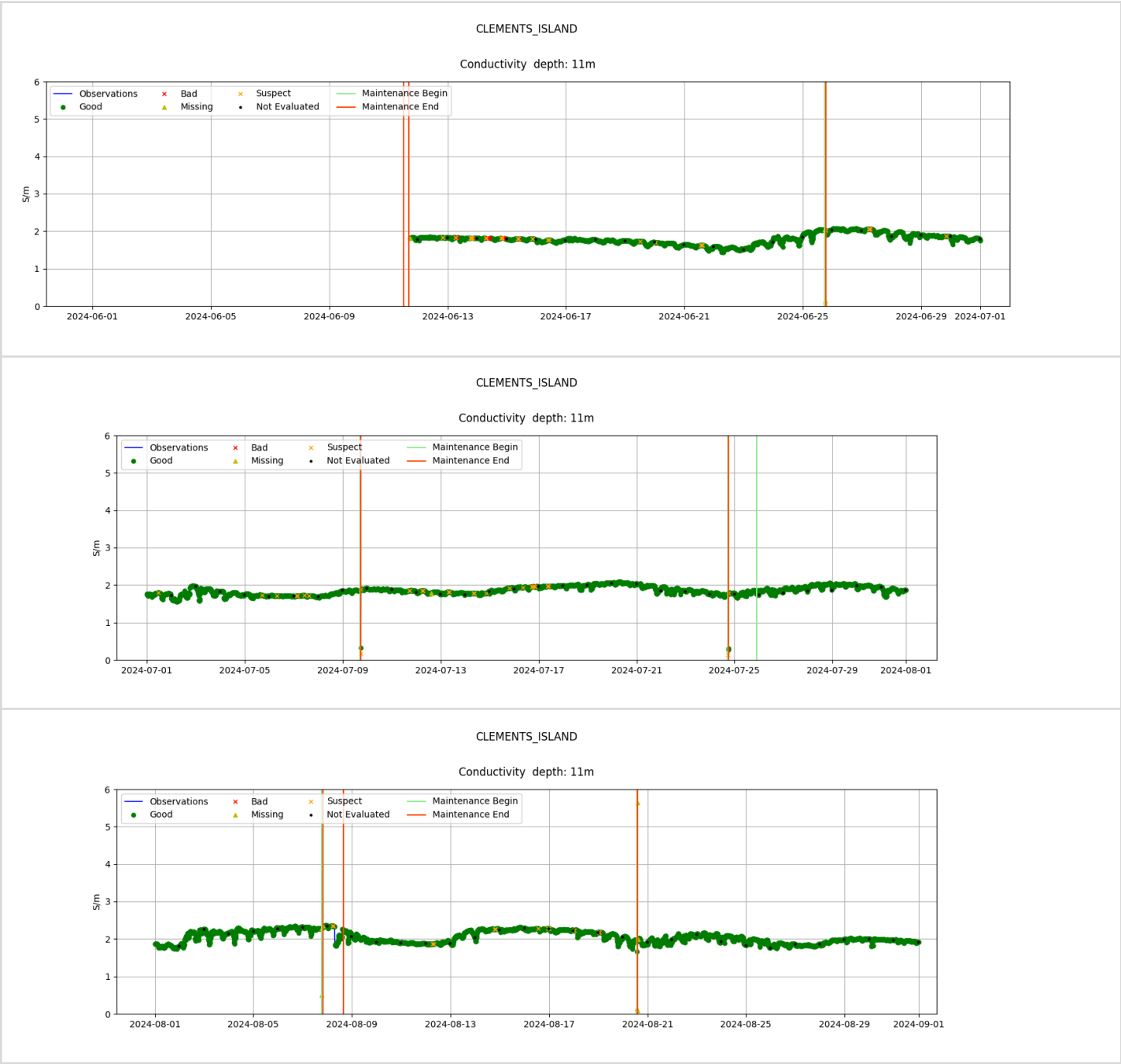


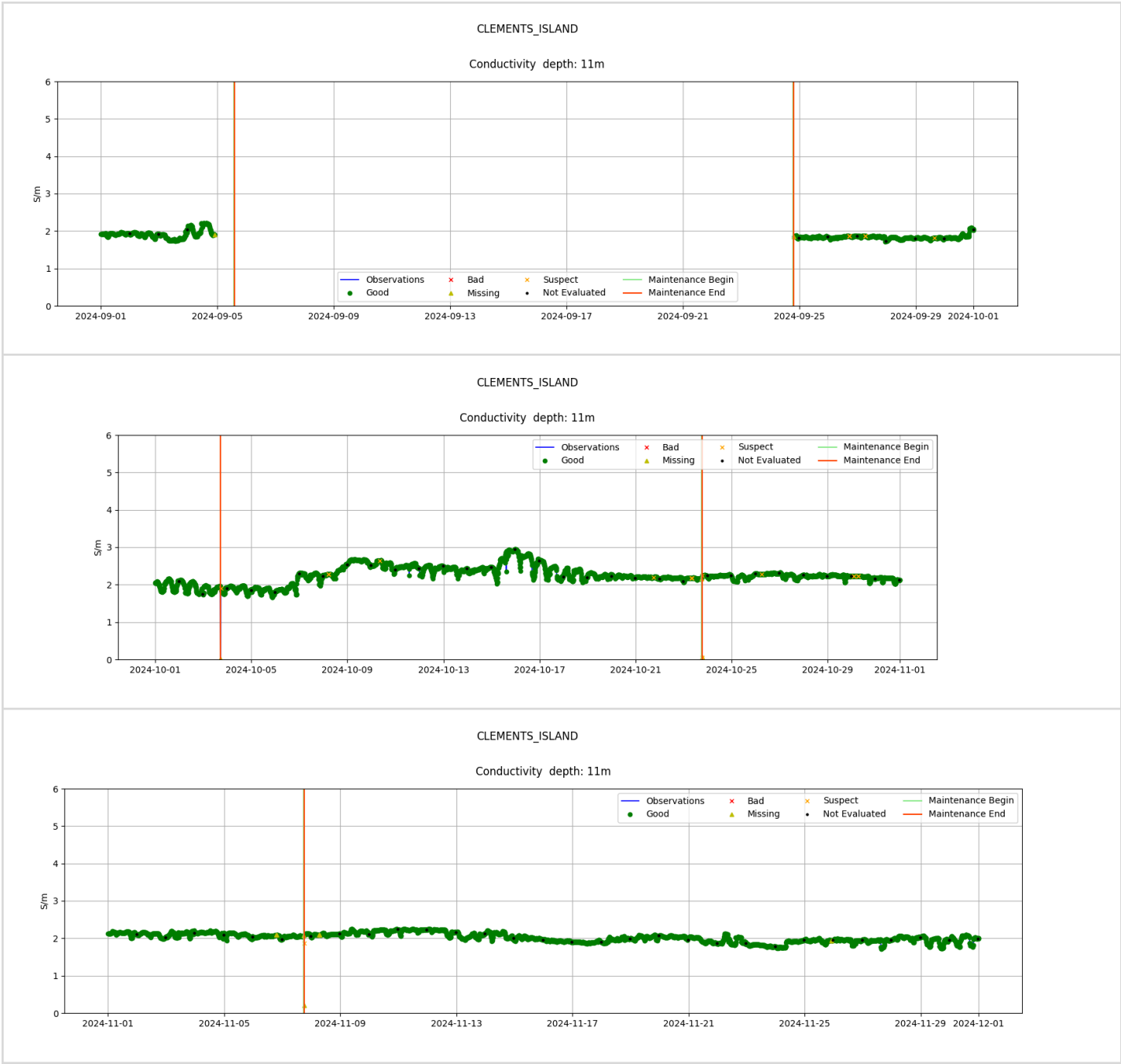


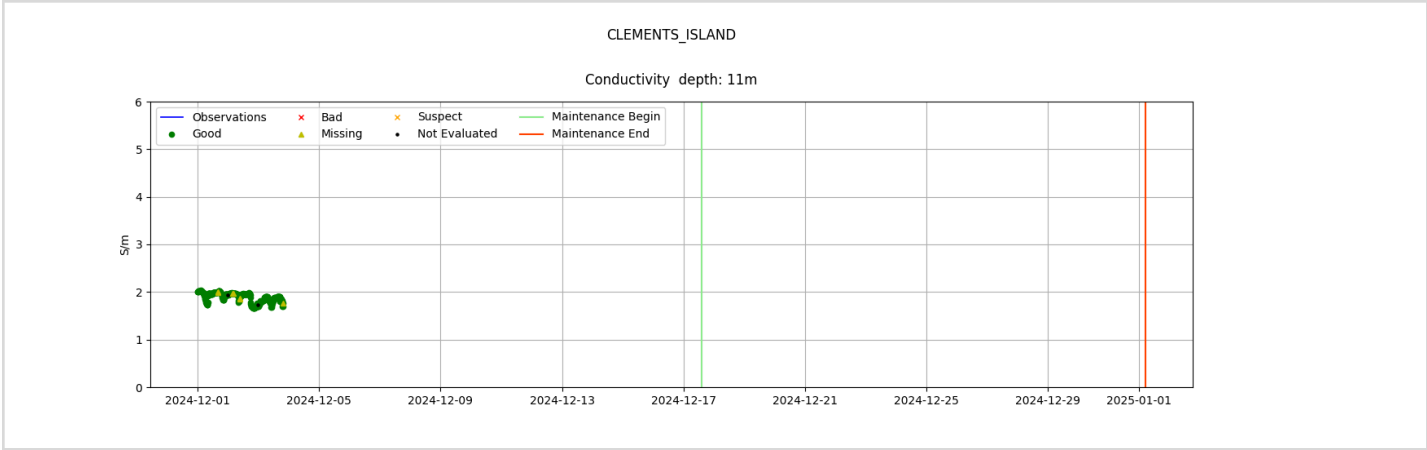




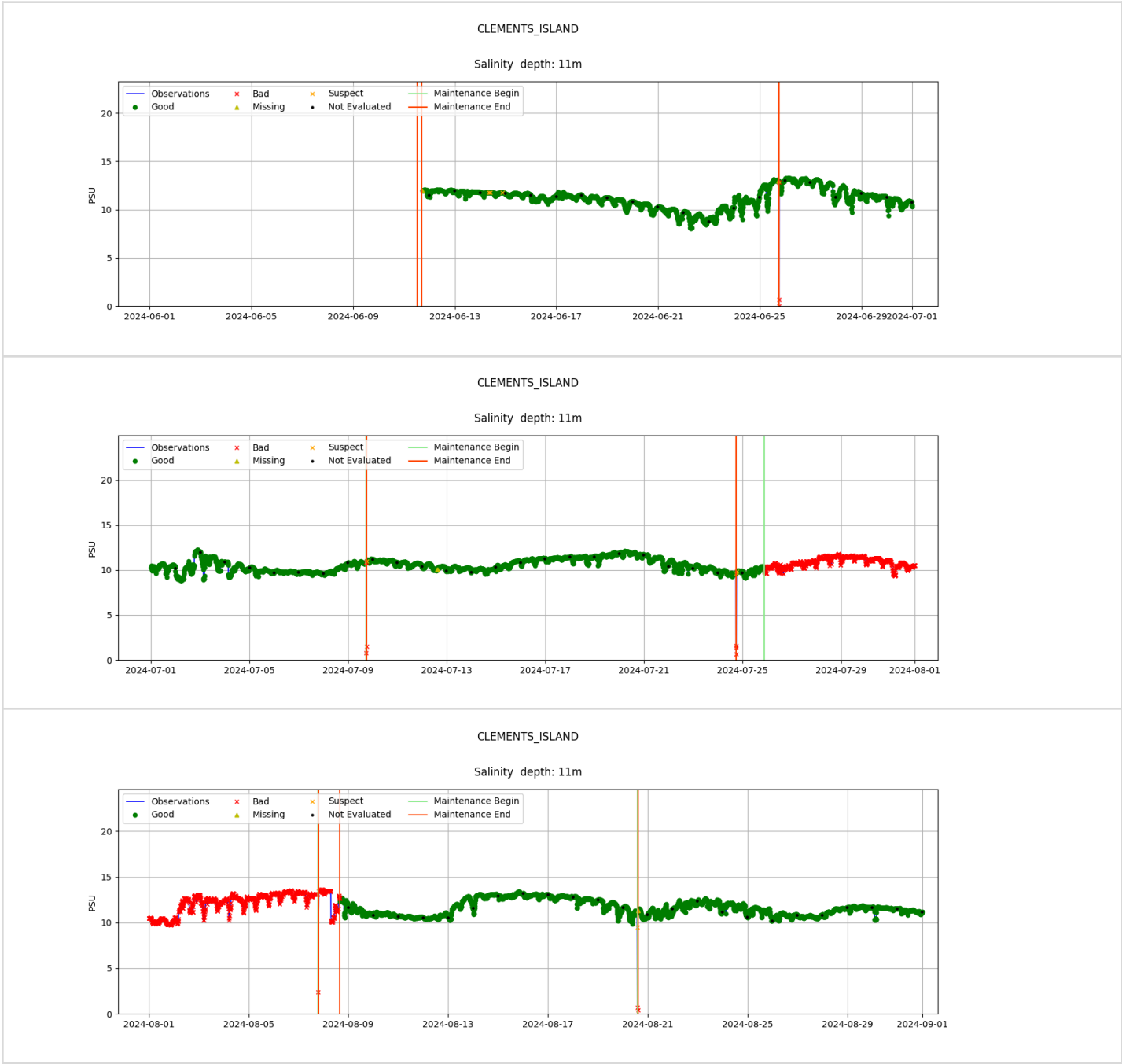
Clements Island 11m Conductivity

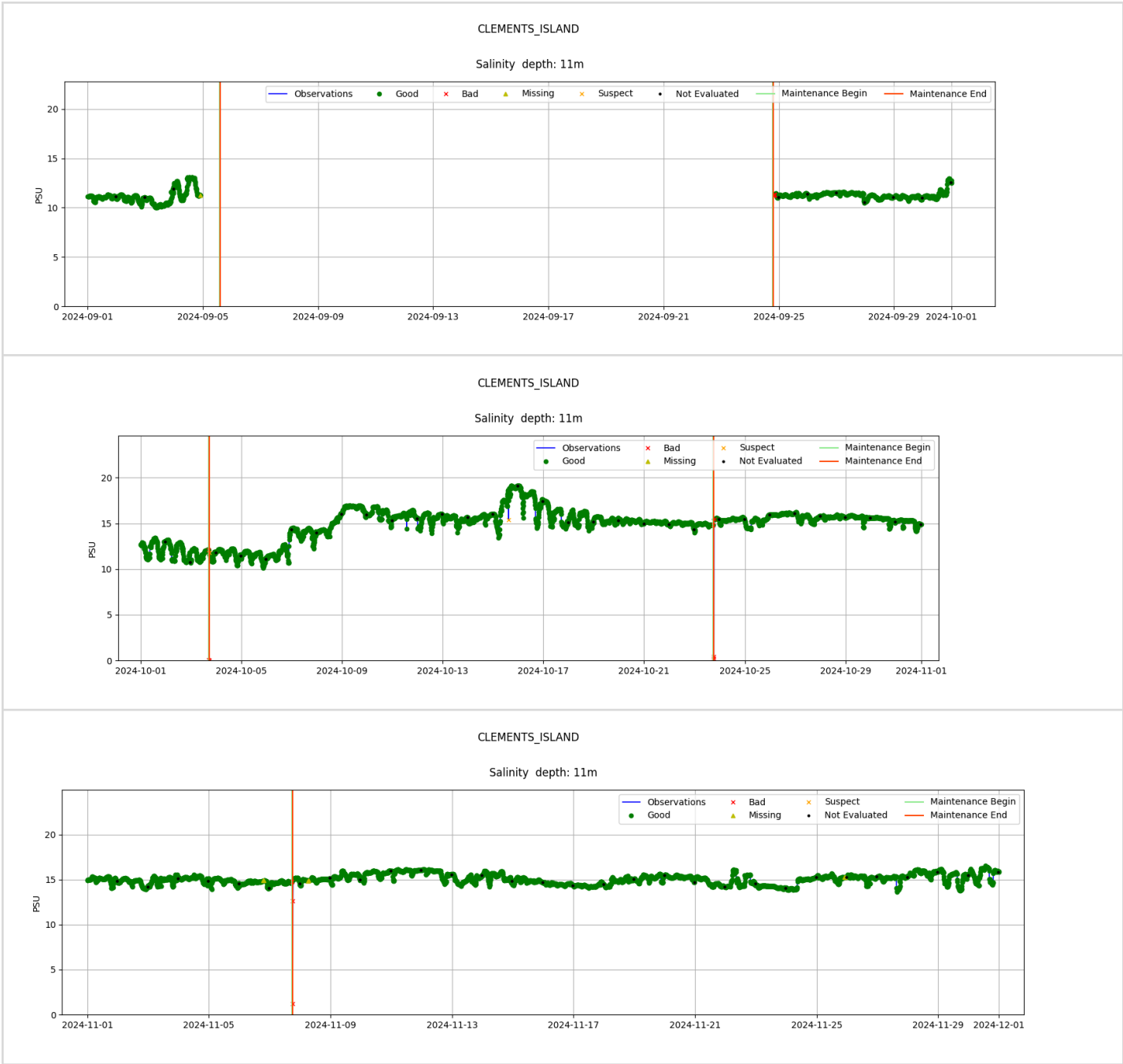


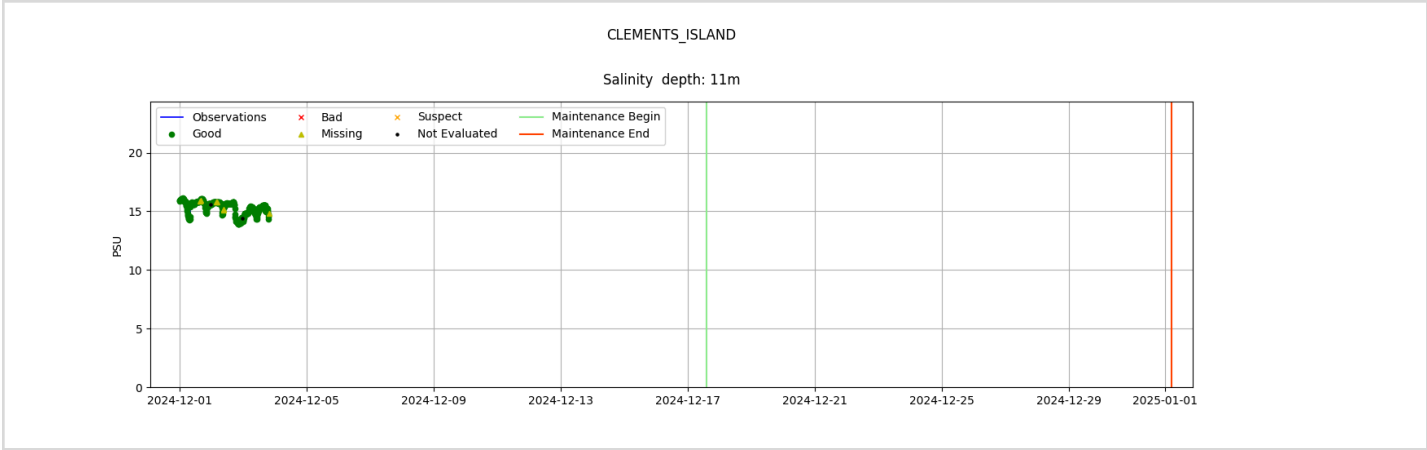




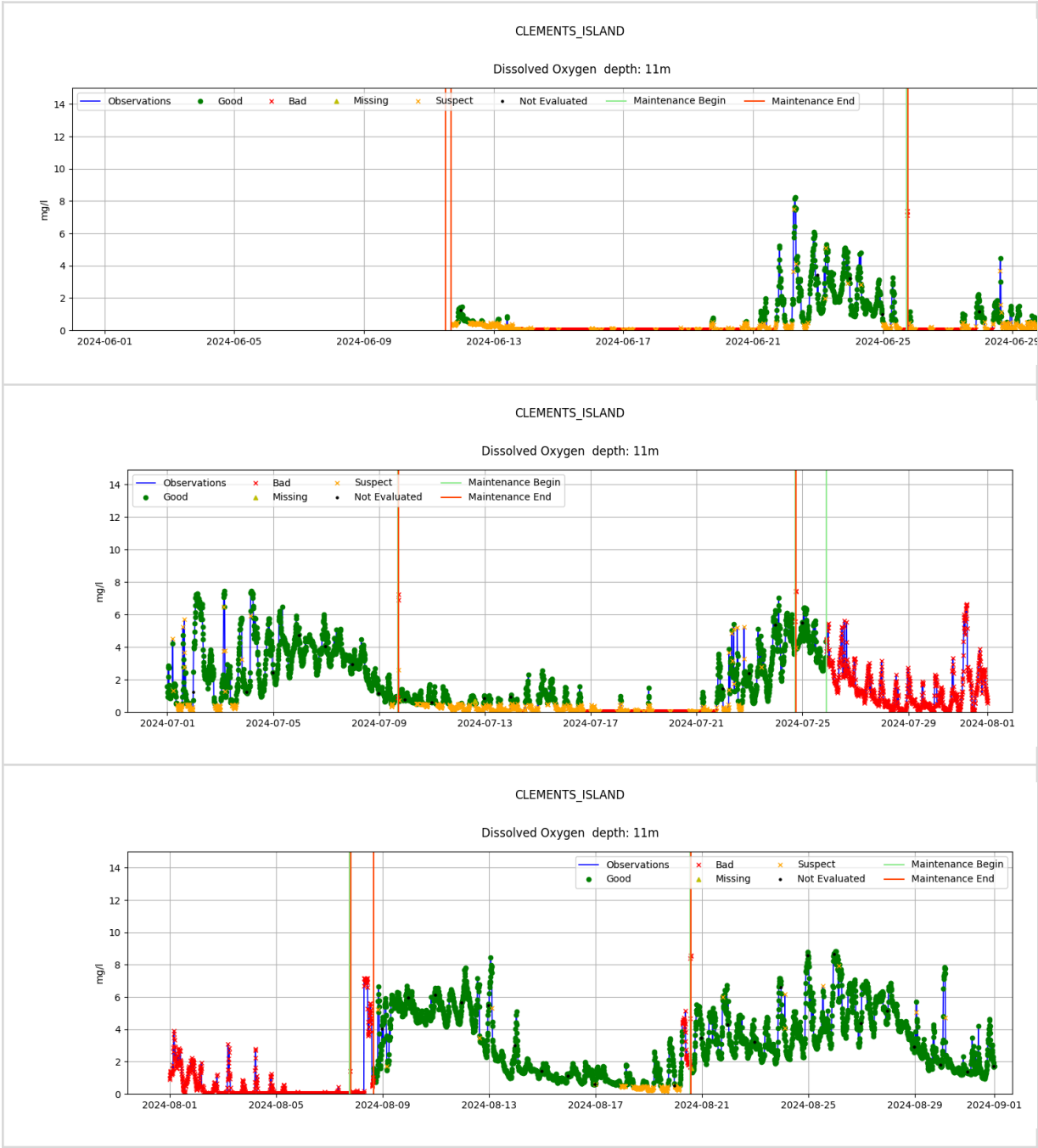
Clements Island 11m Salinity

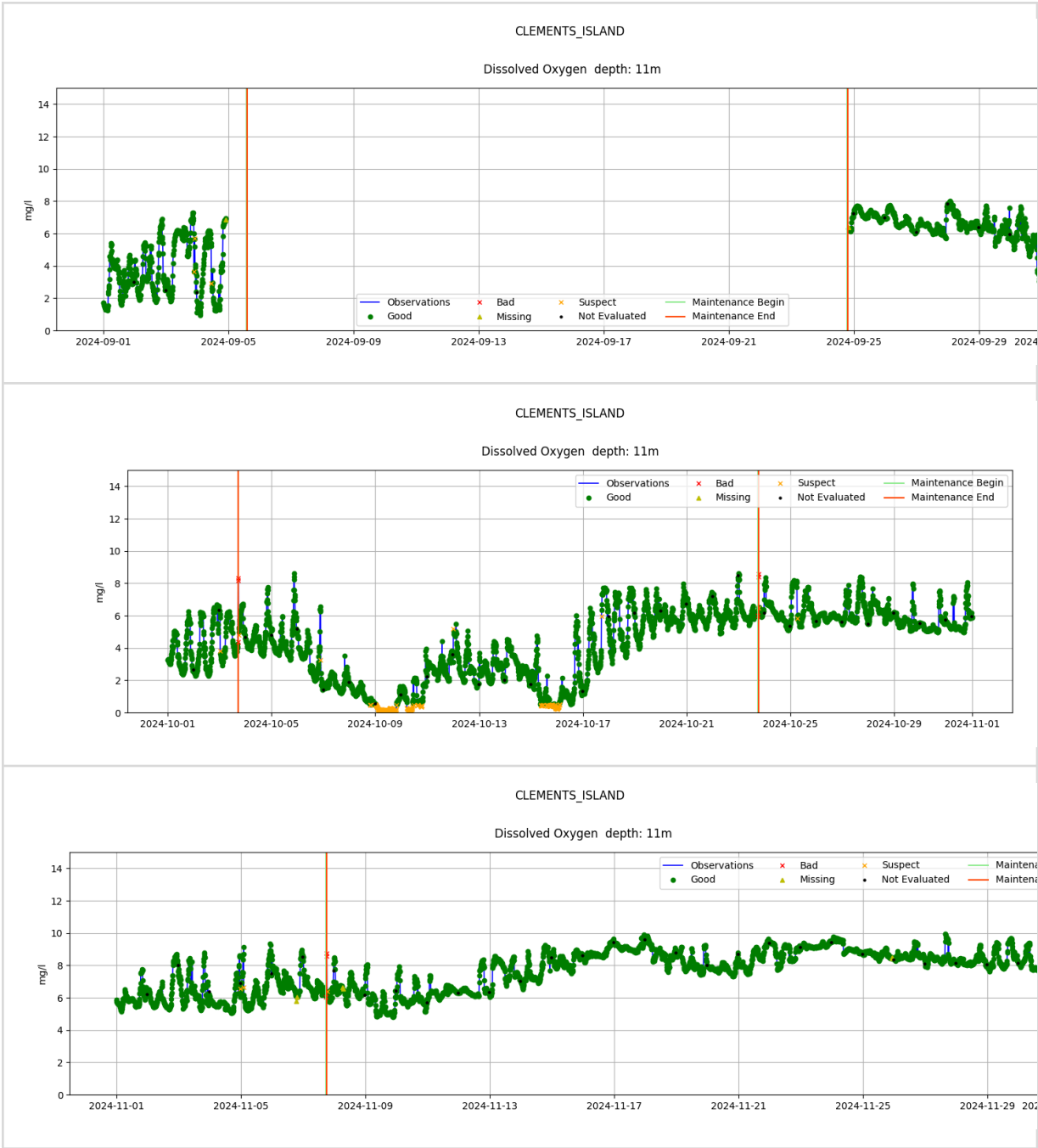




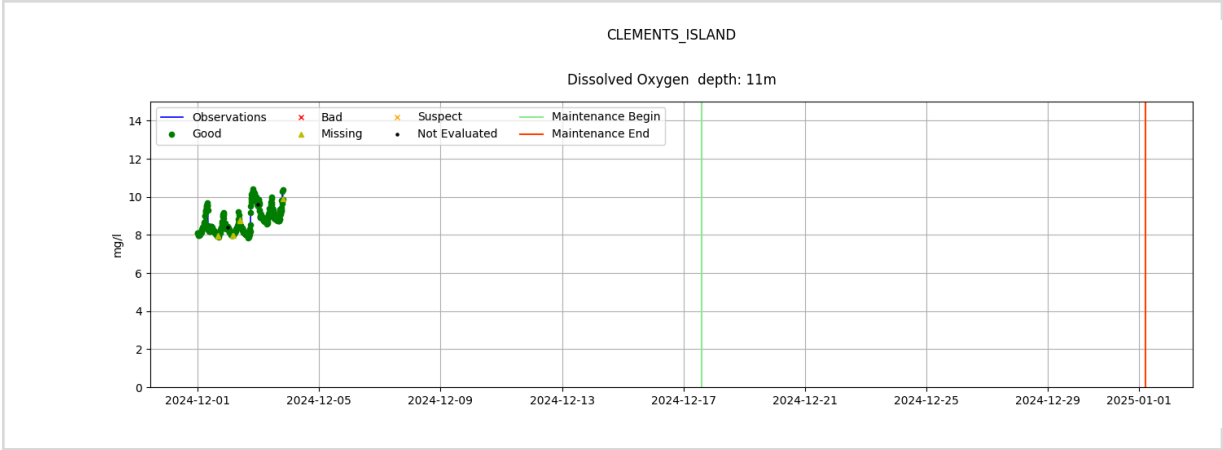


Clements Island 11m Dissolved Oxygen



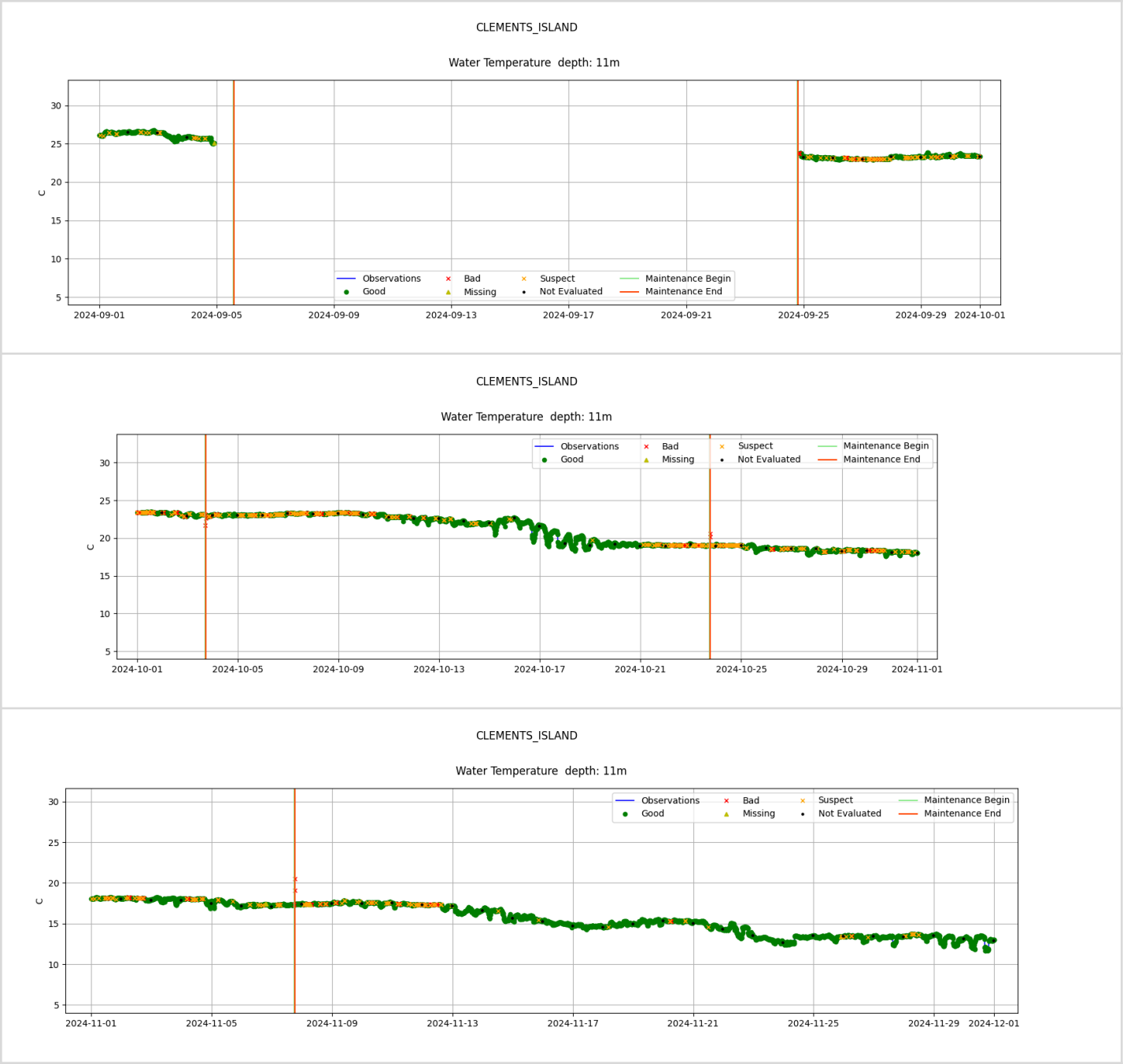


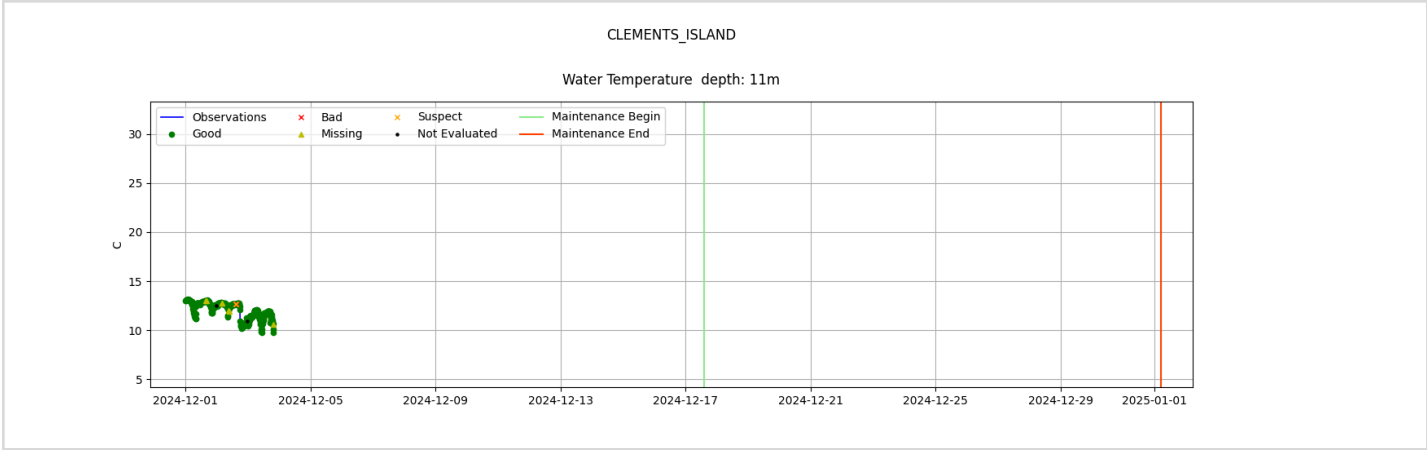




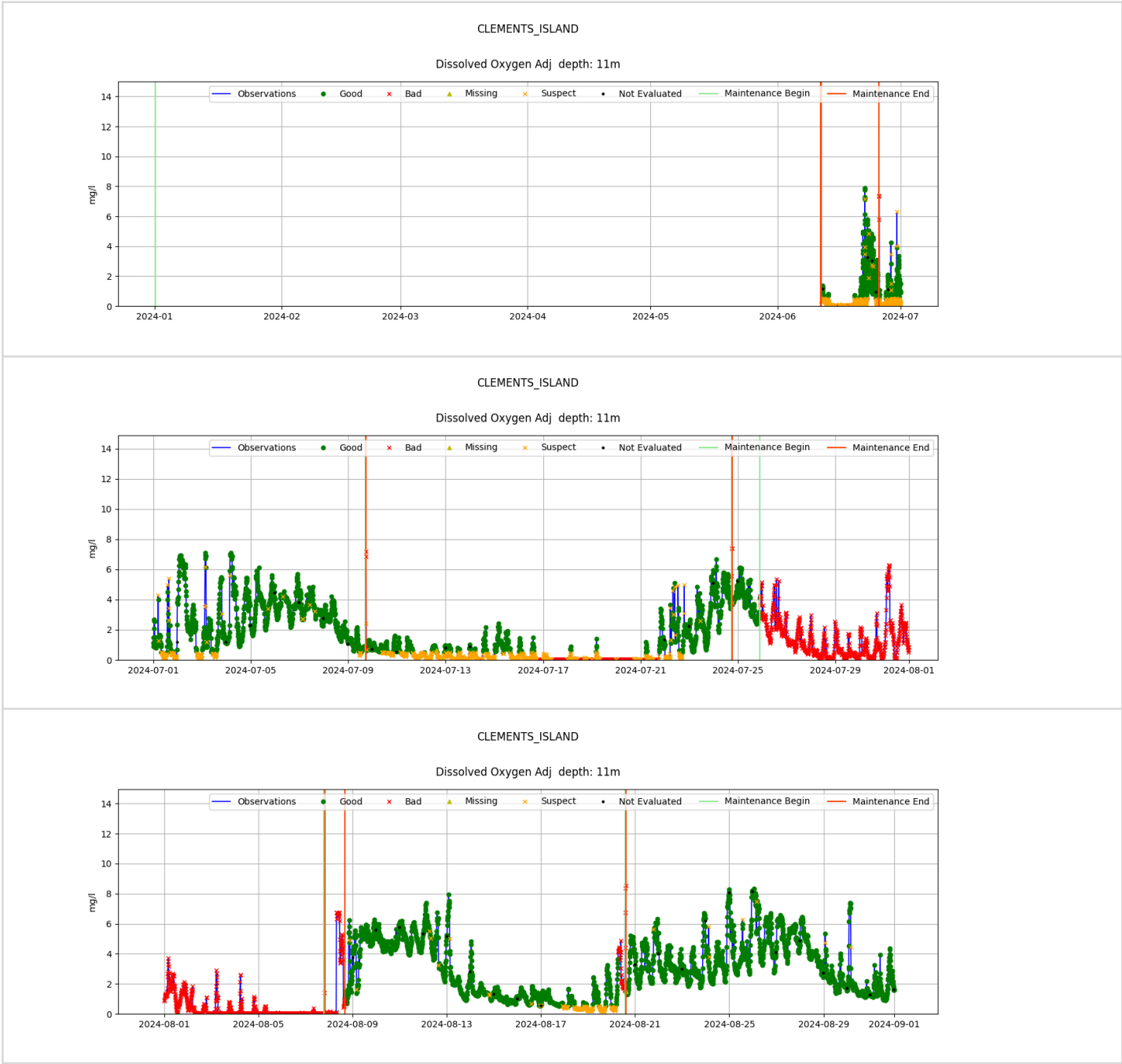
Clements Island 11m Water Temperature



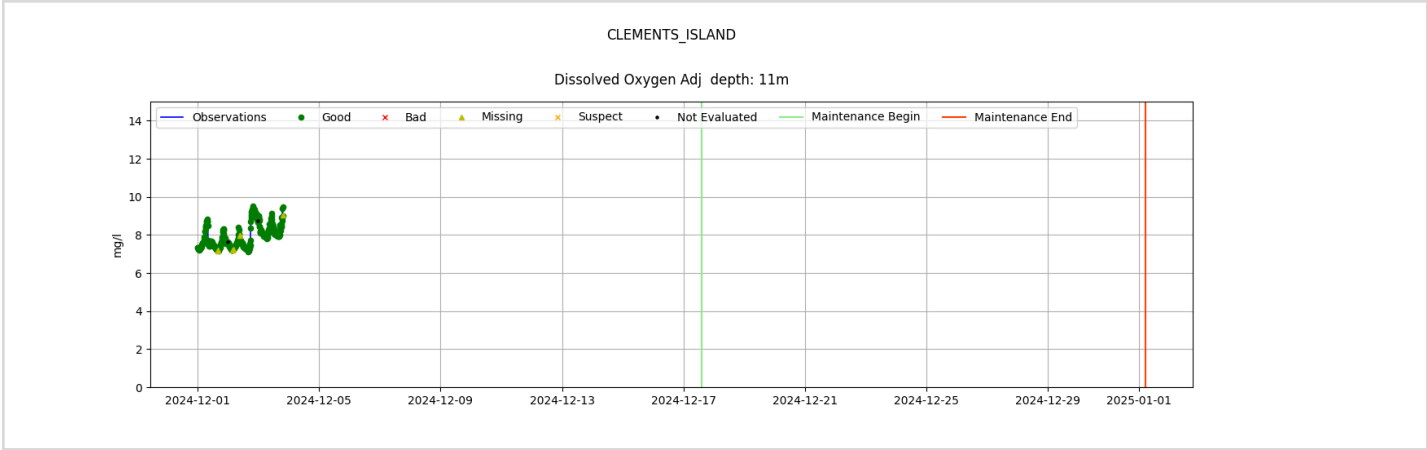




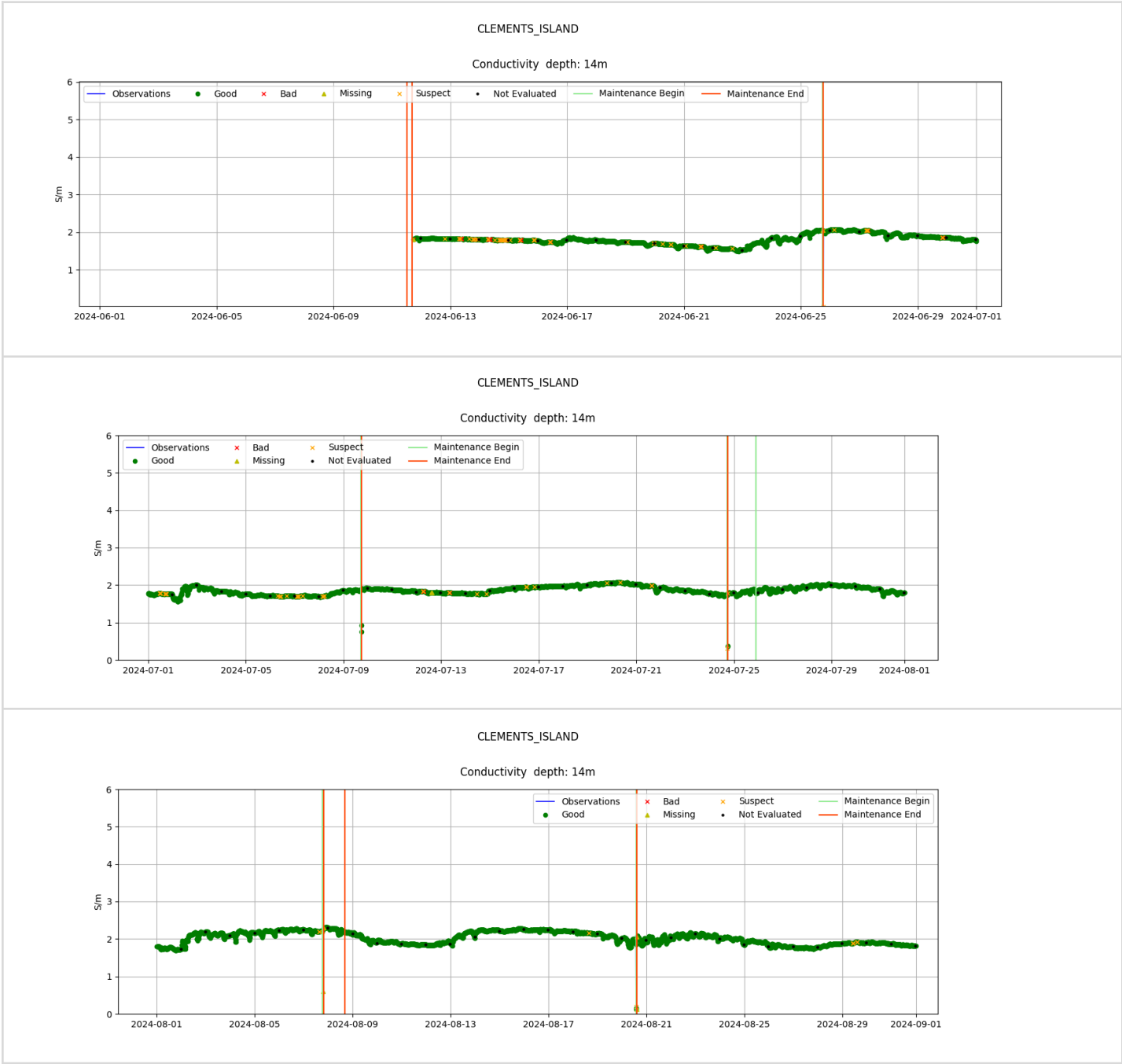
Clements Island 11m Dissolved Oxygen Adjusted



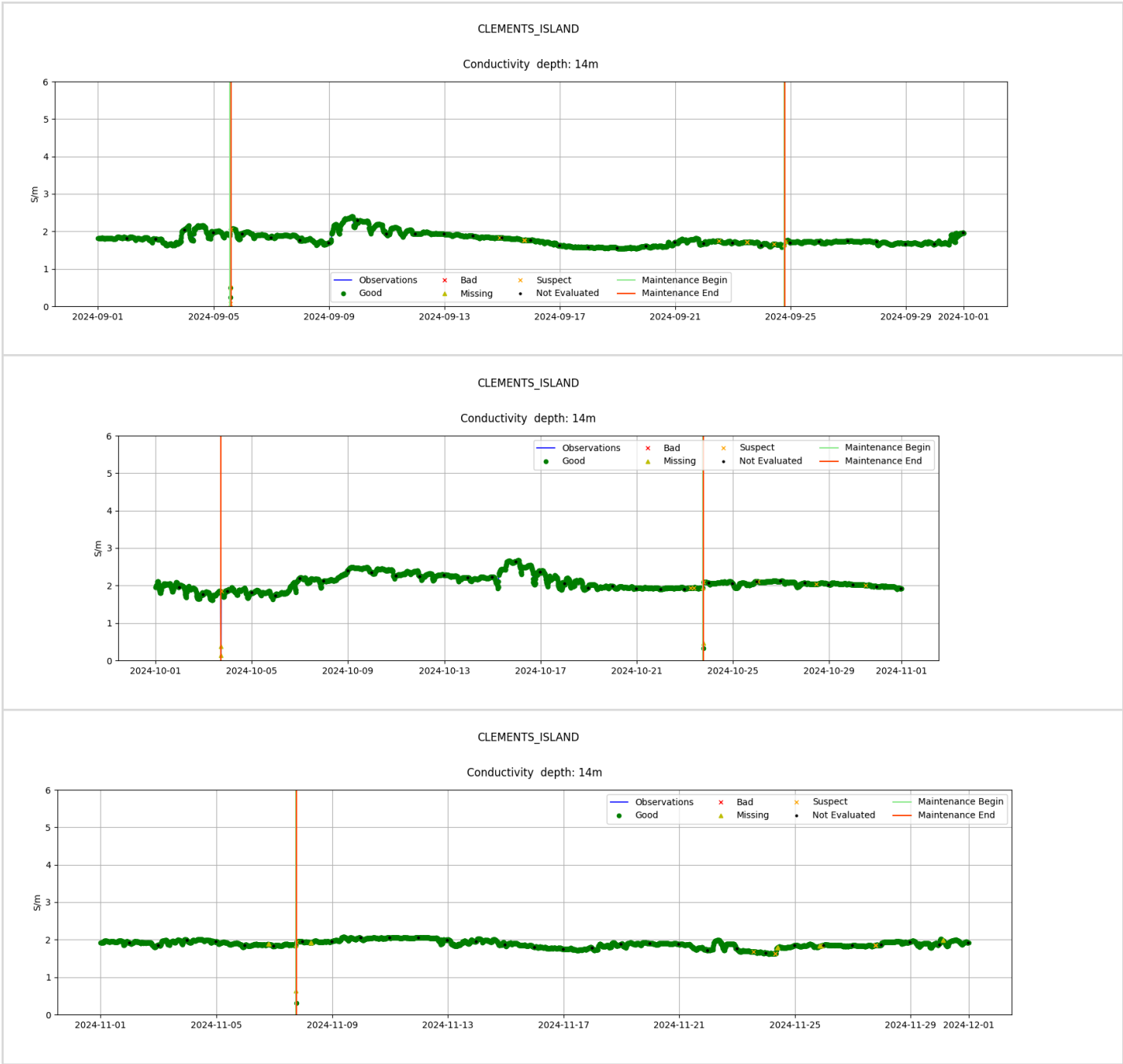


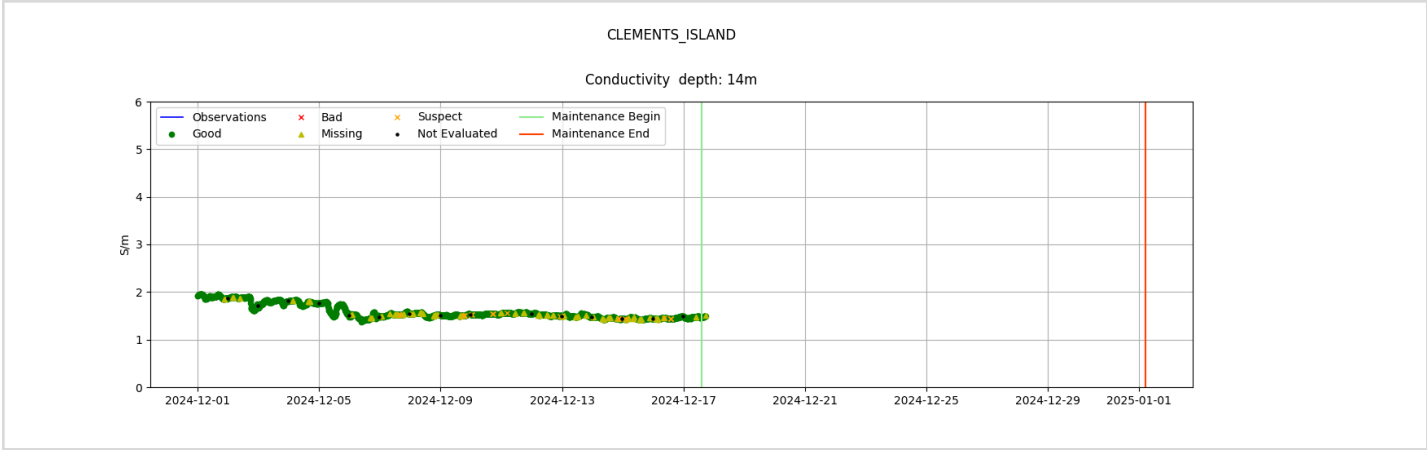


Clements Island 14m Conductivity

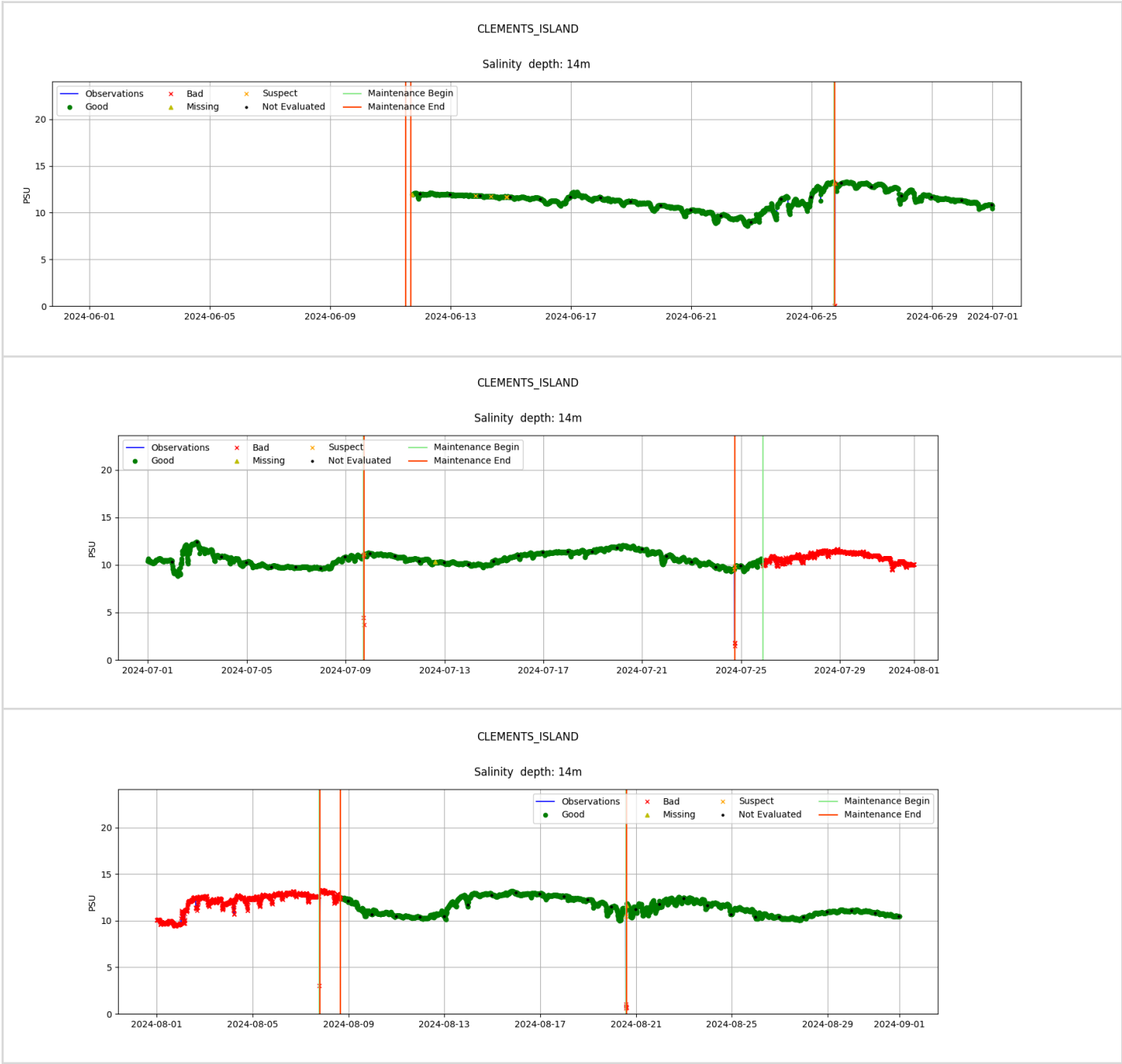


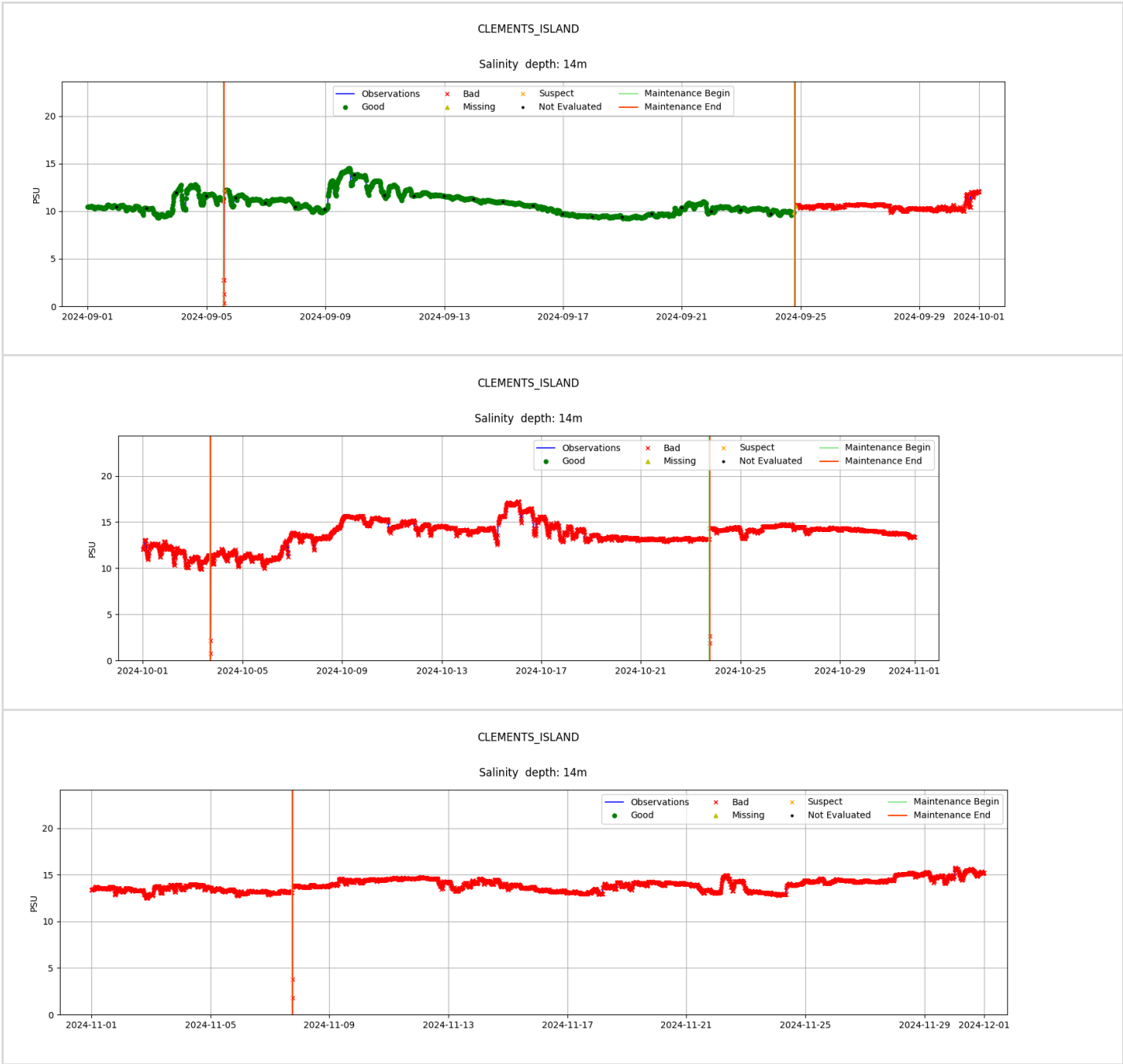


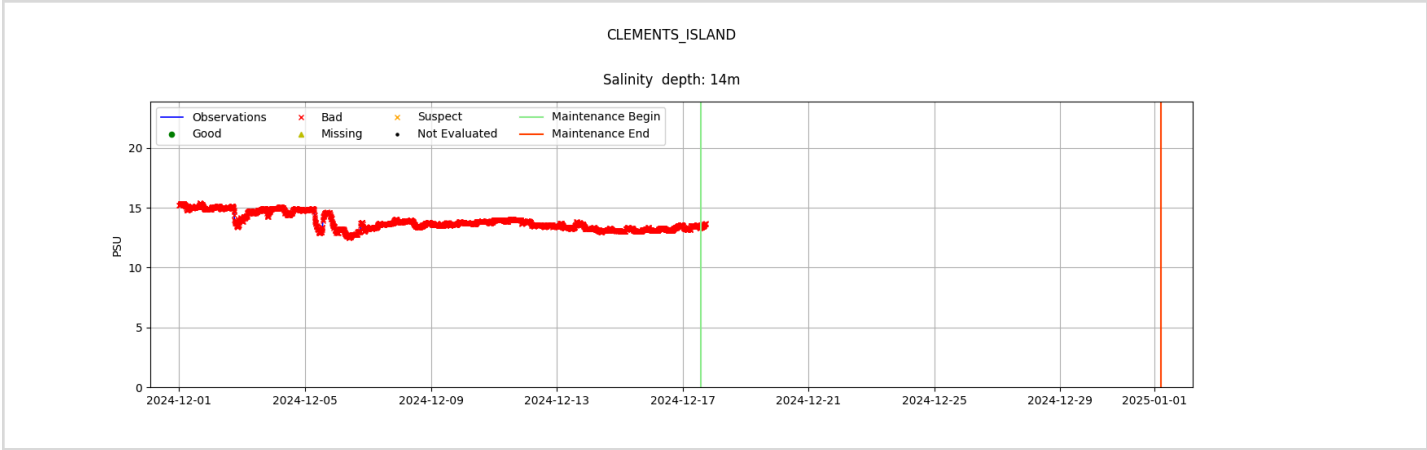




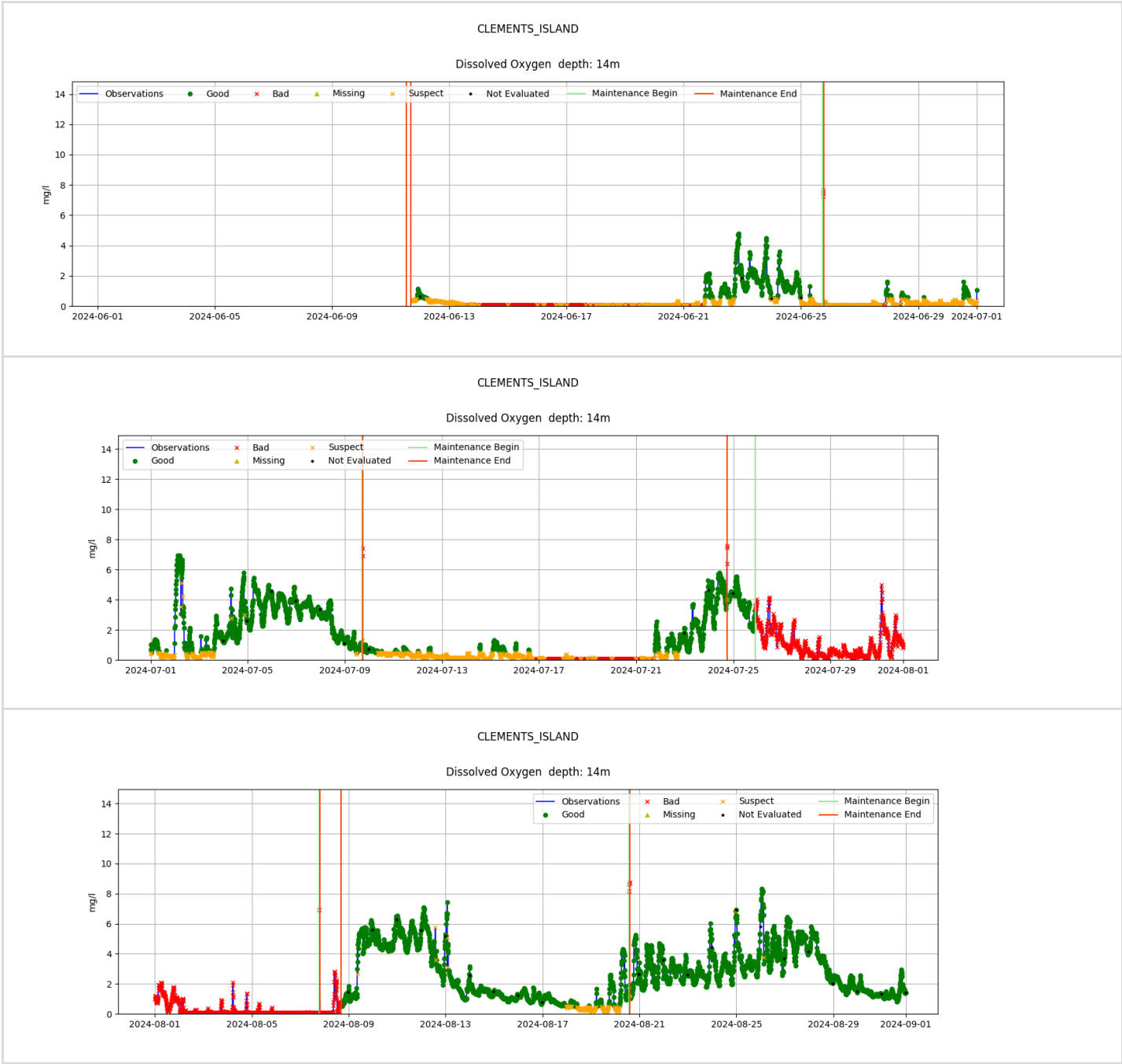
Clements Island 14m Salinity

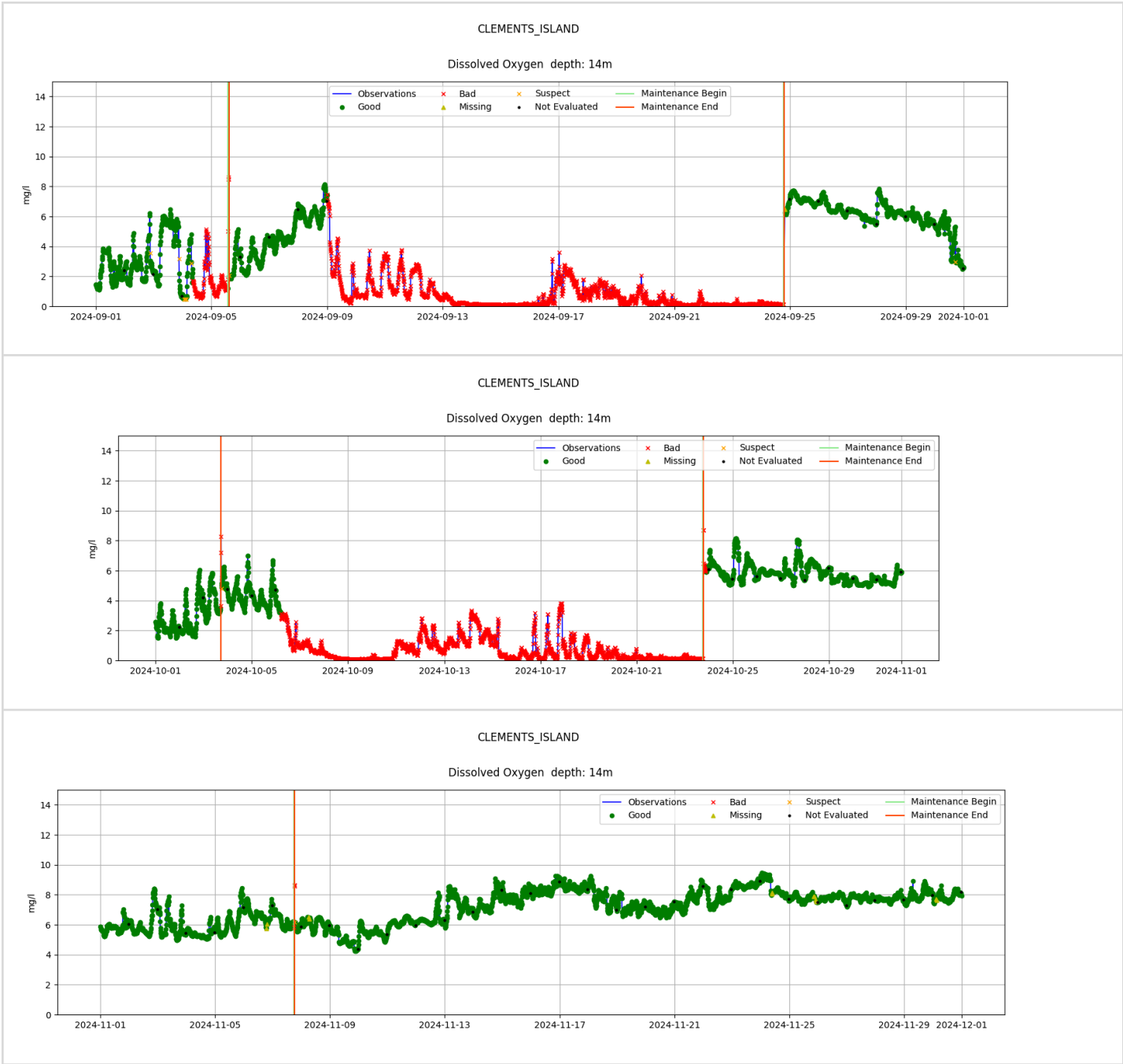


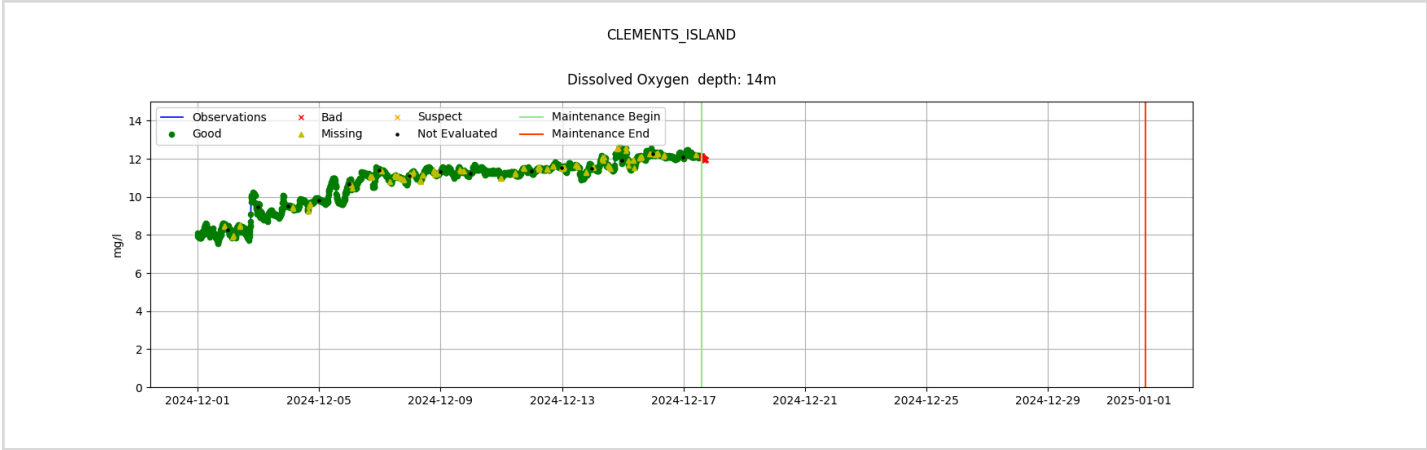




Clements Island 14m Dissolved Oxygen



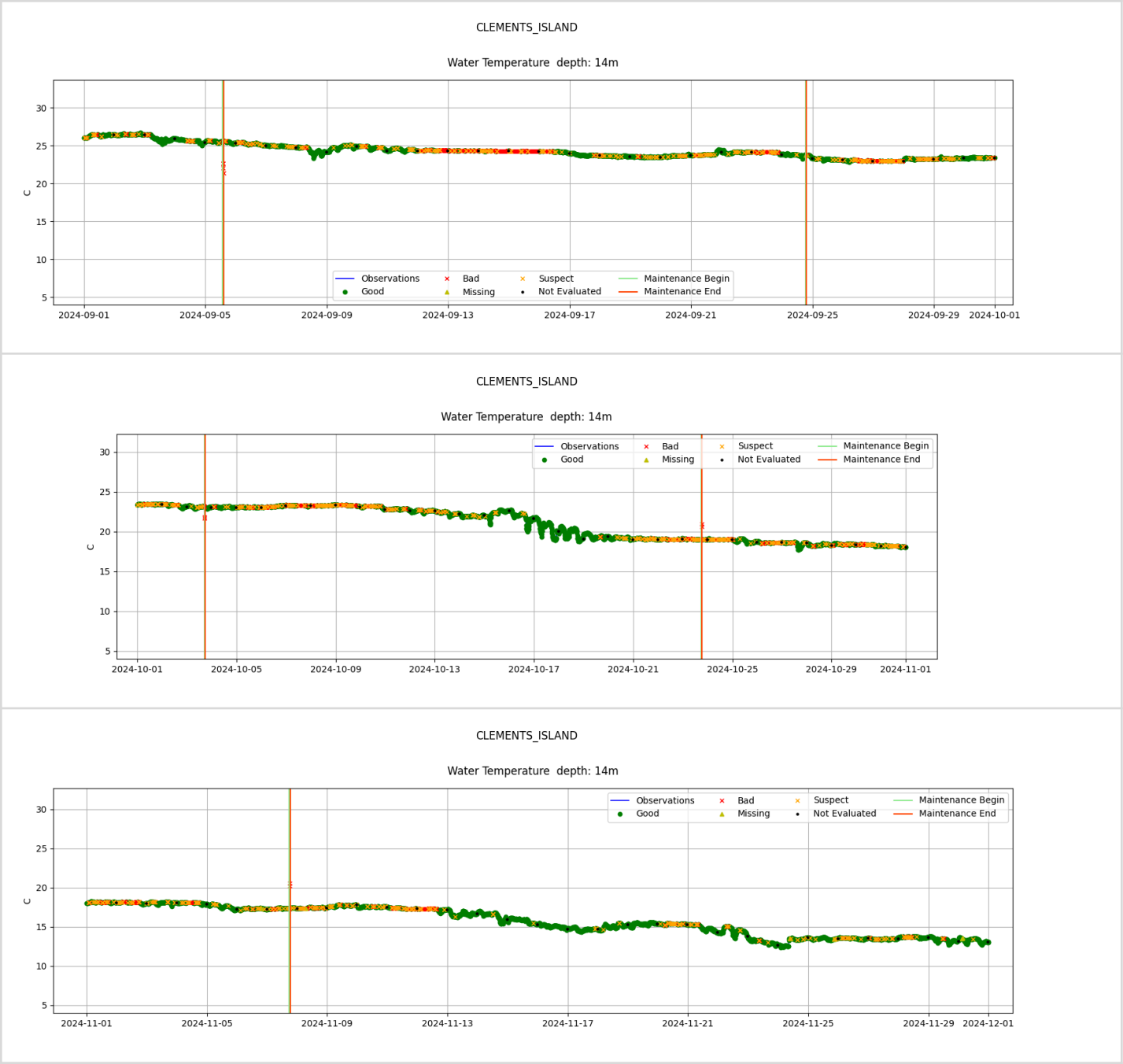


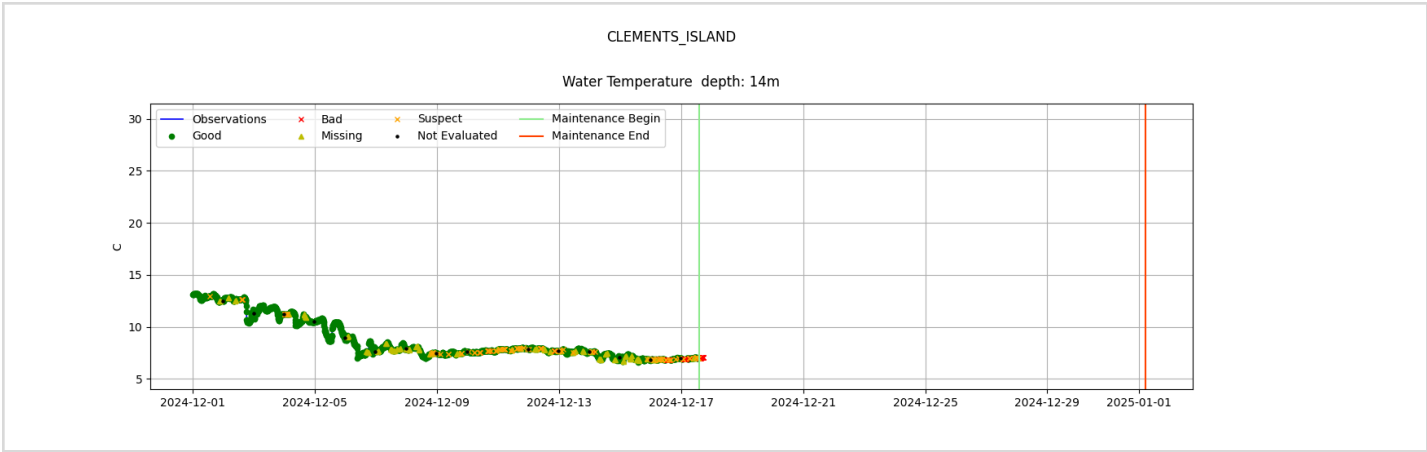




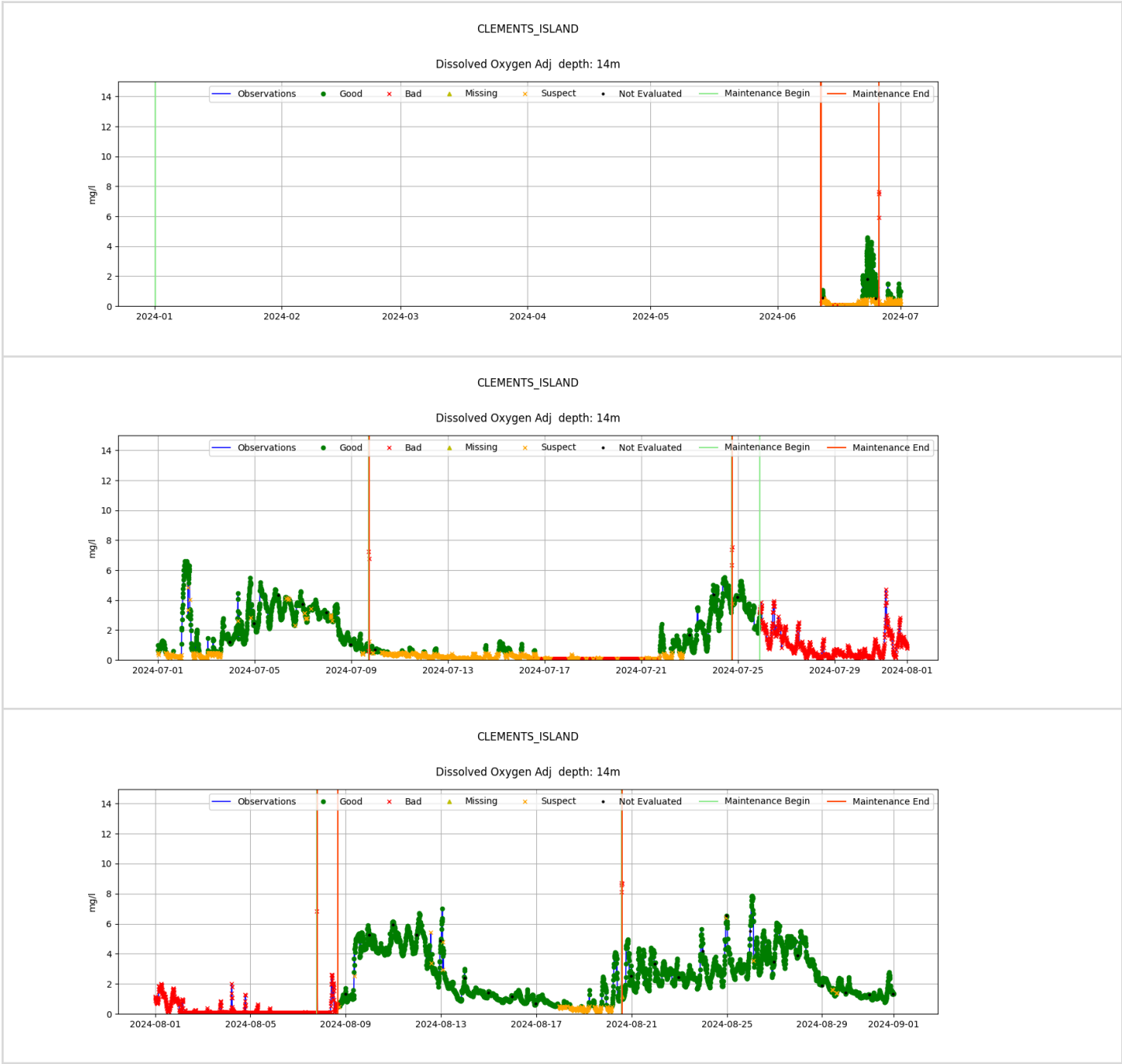
Clements Island 14m Water Temperature



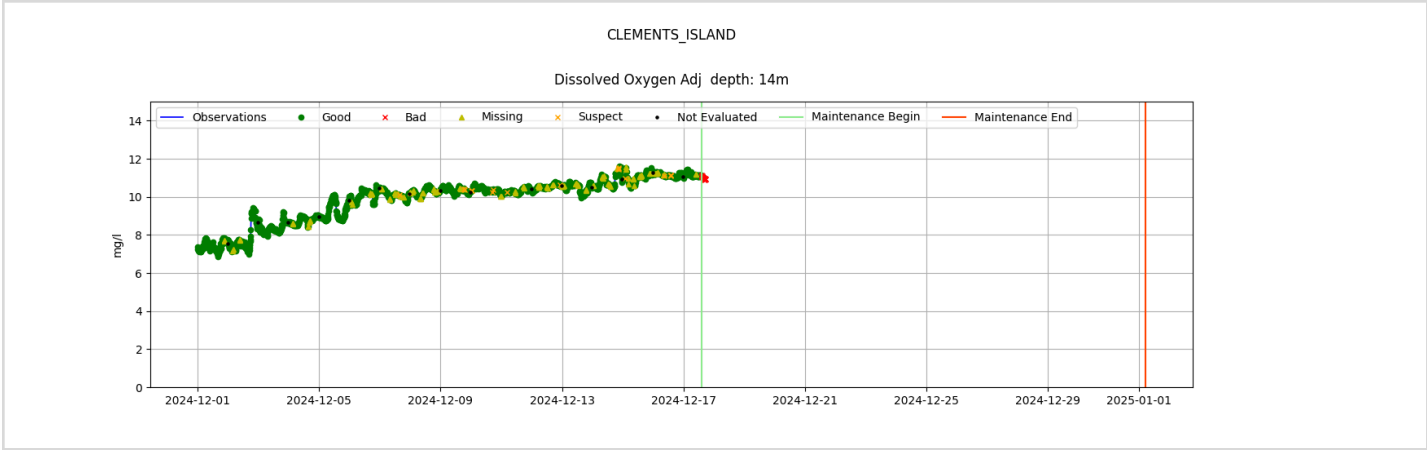




Clements Island 14m Dissolved Oxygen Adjusted

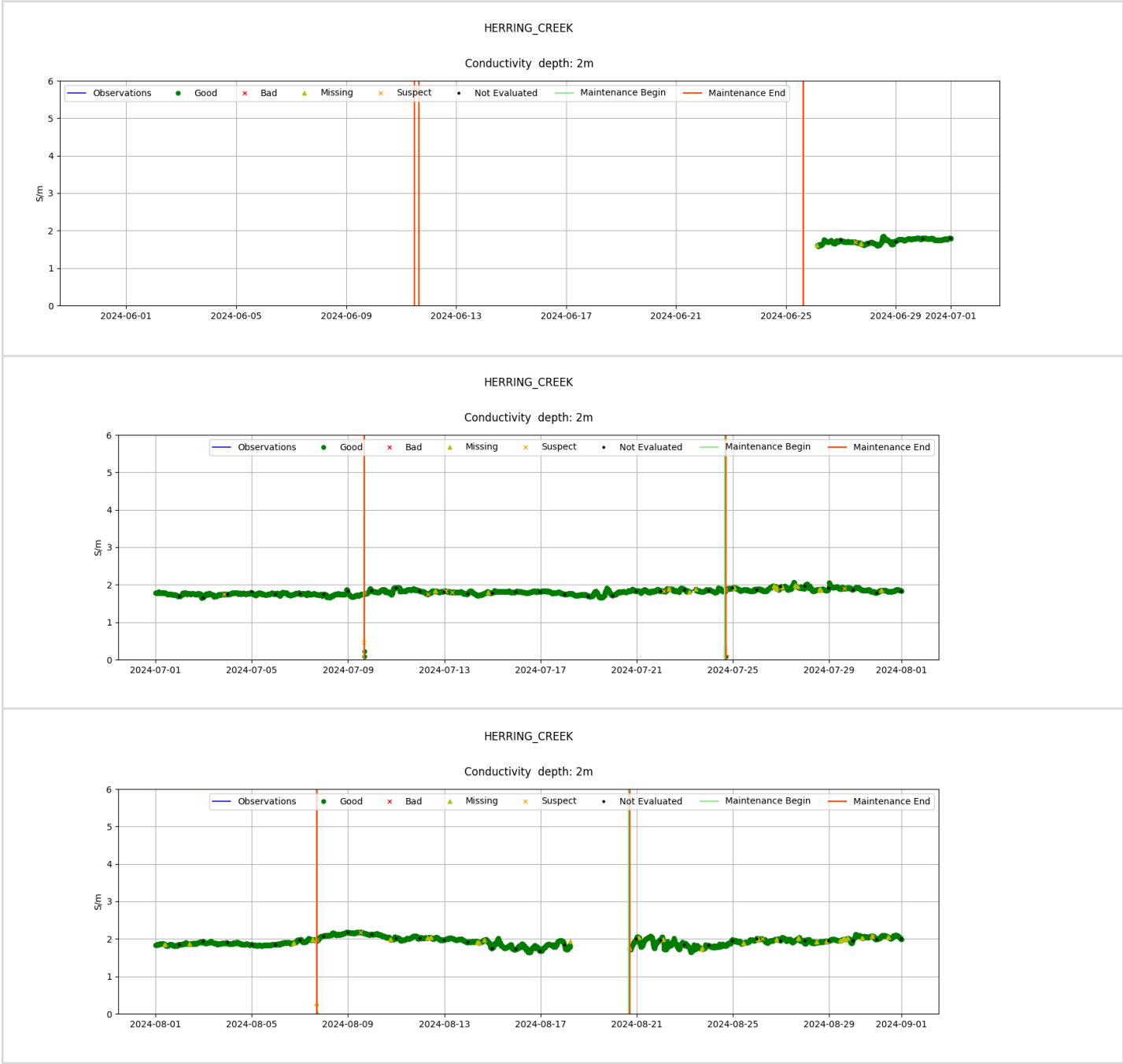


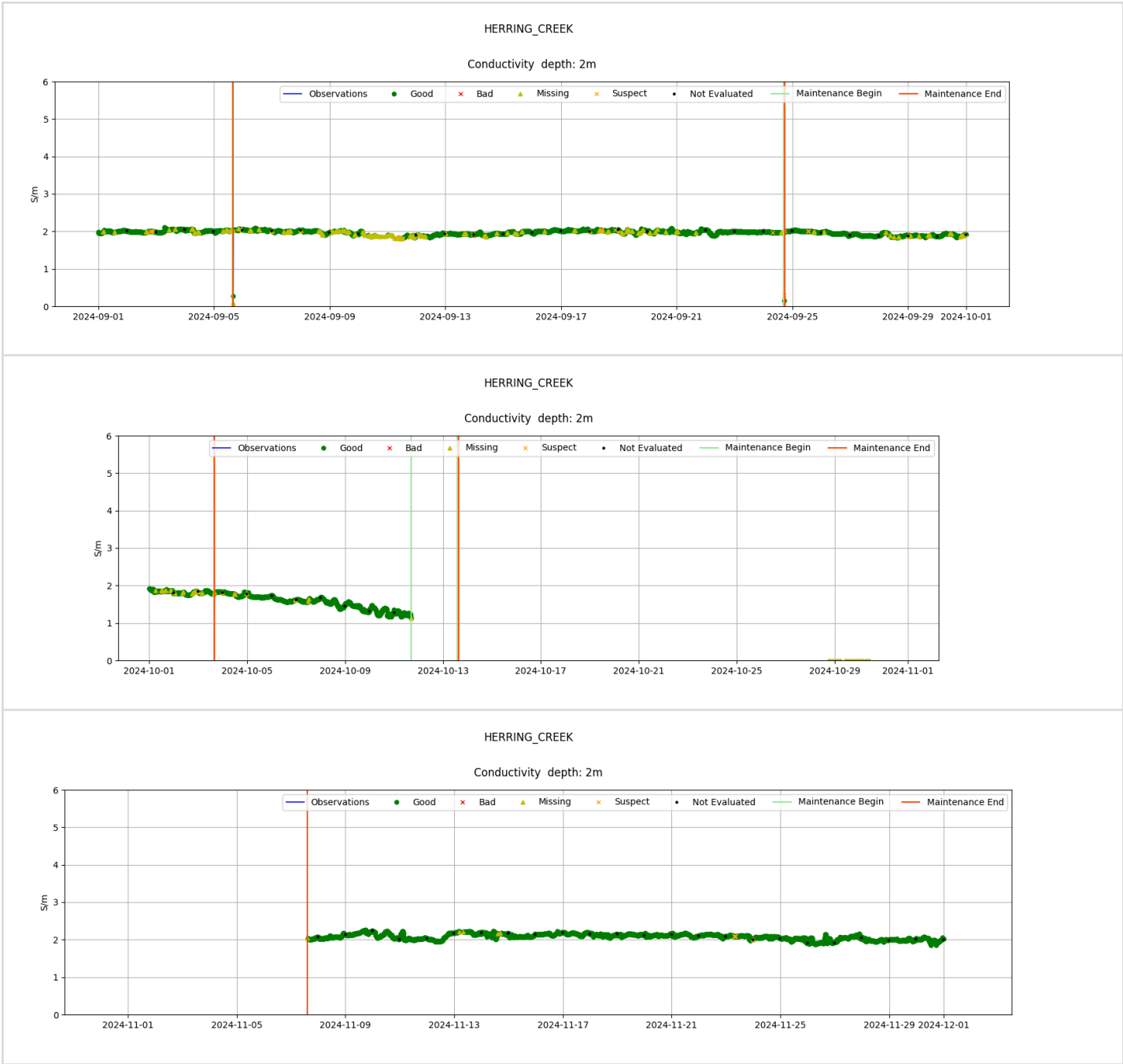




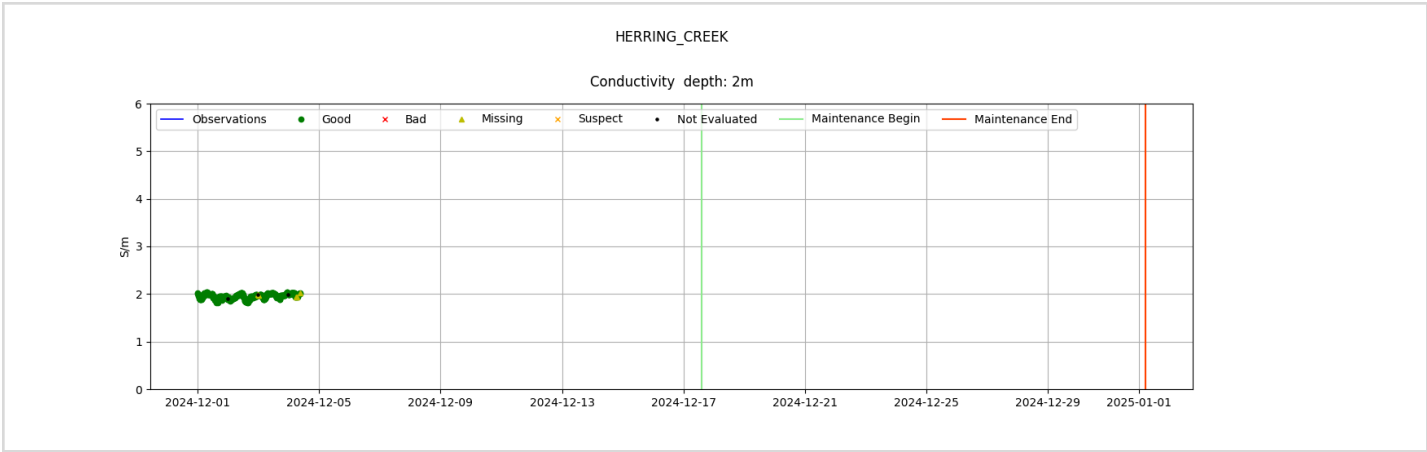
# 8.4 Herring Creek

## Herring Creek 2m Conductivity

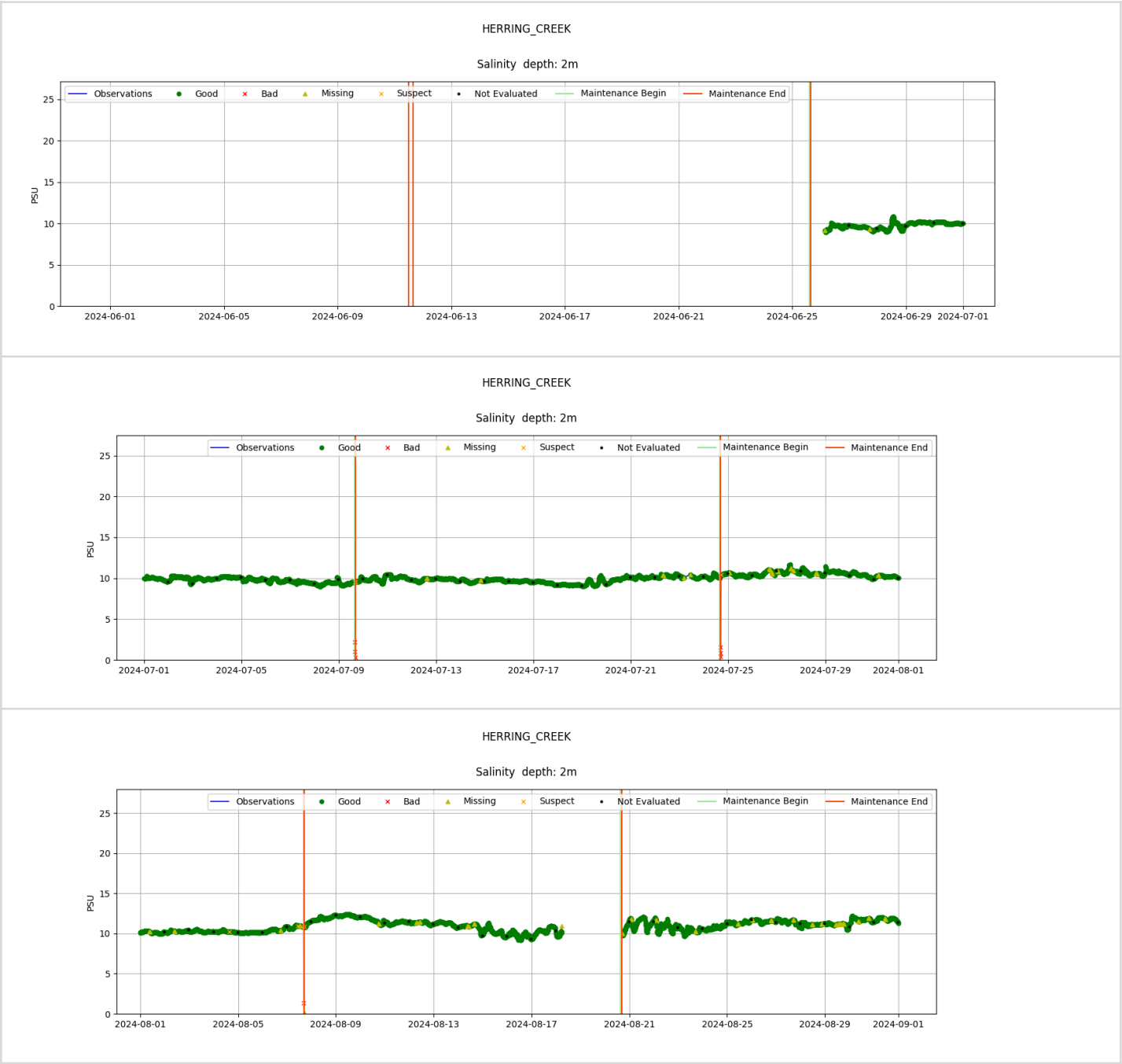


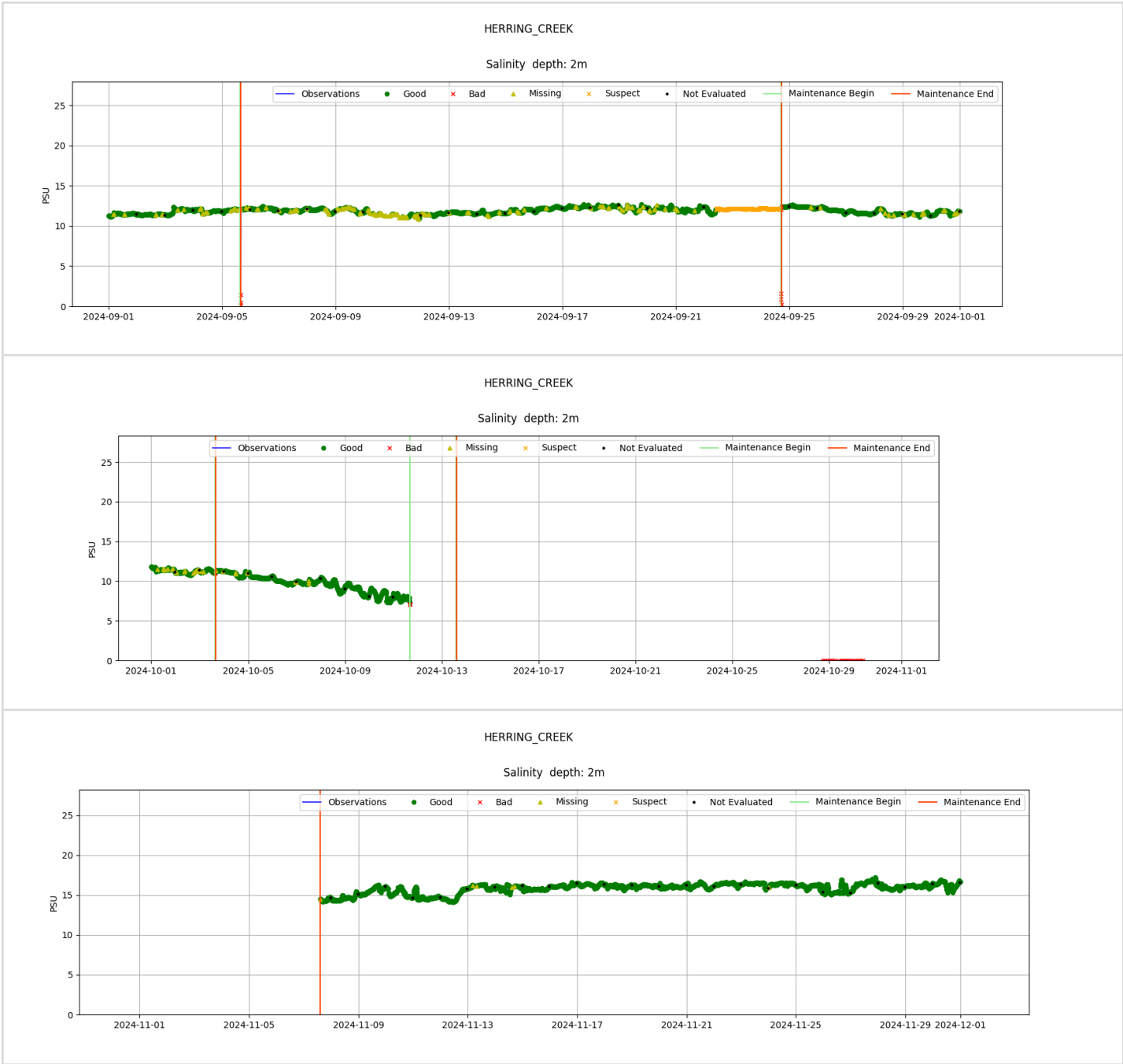


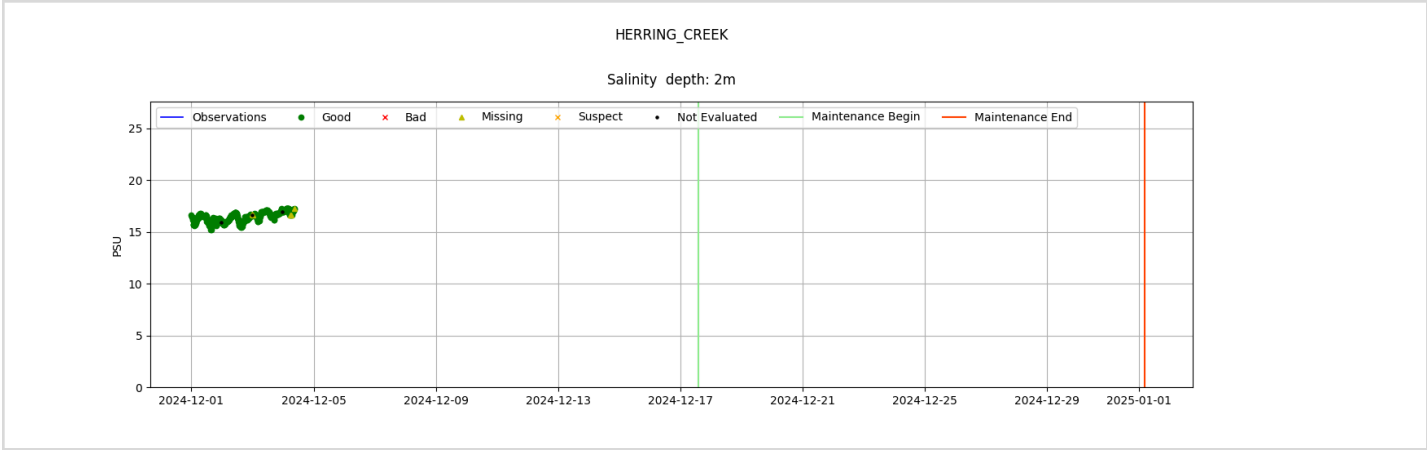




Herring Creek 2m Salinity



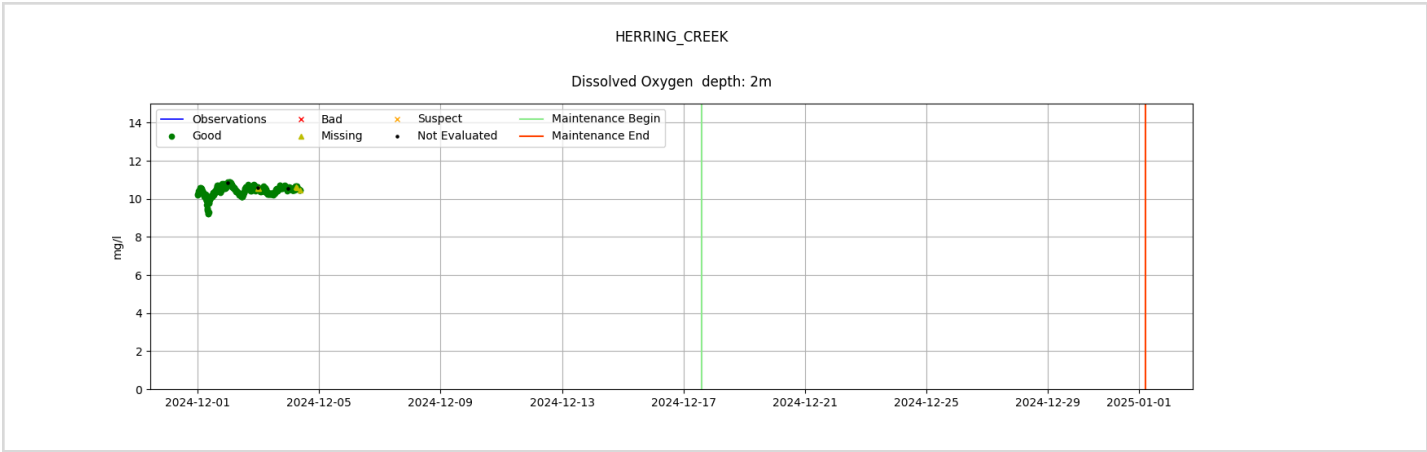




Herring Creek 2m Dissolved Oxygen



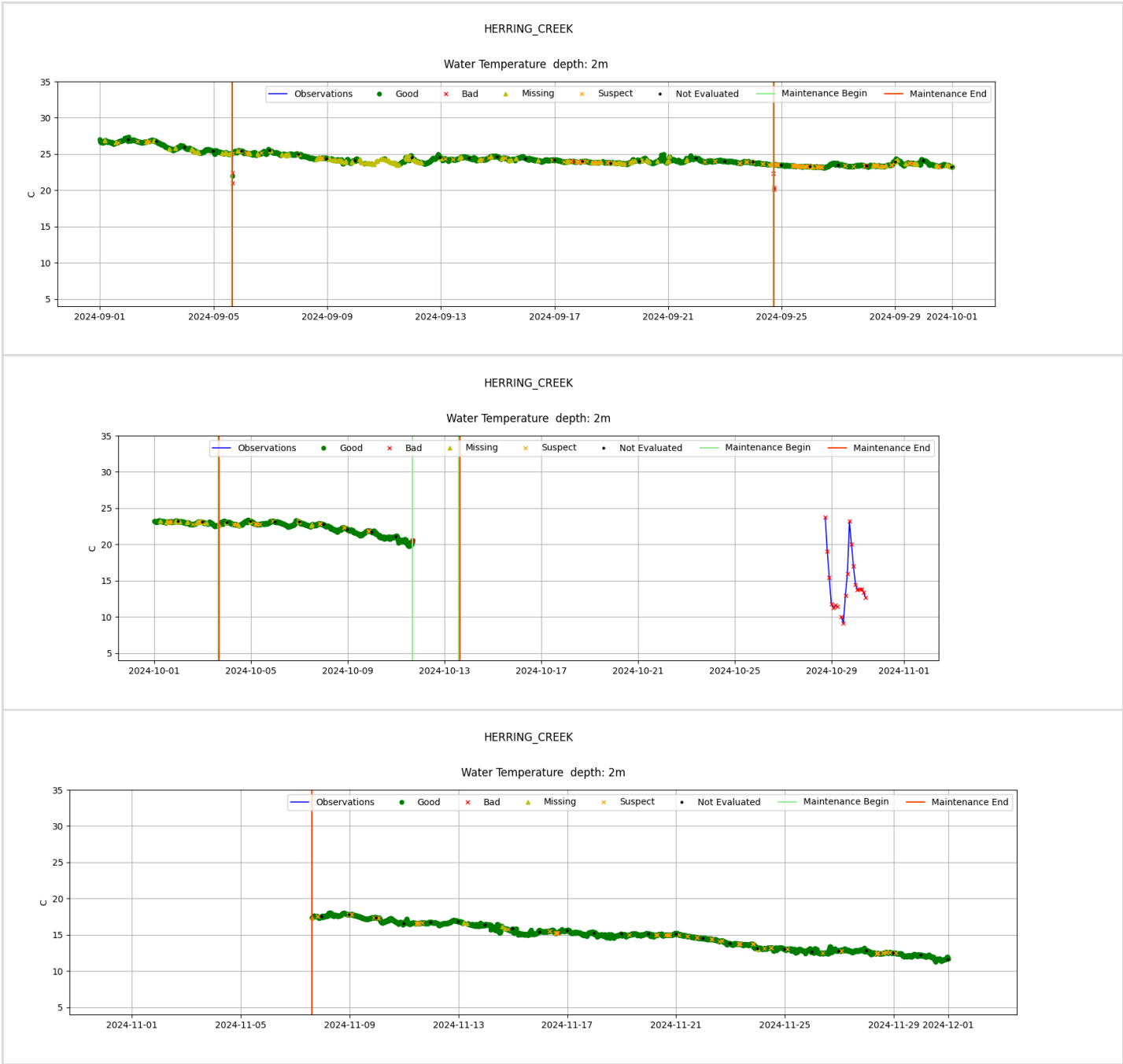


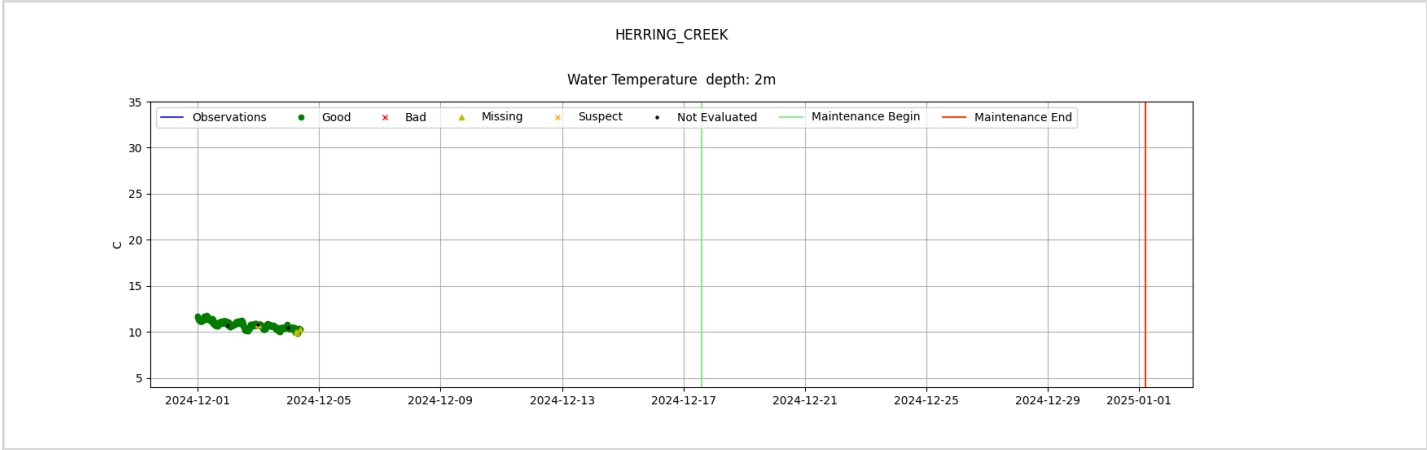


Herring Creek 2m Water Temperature





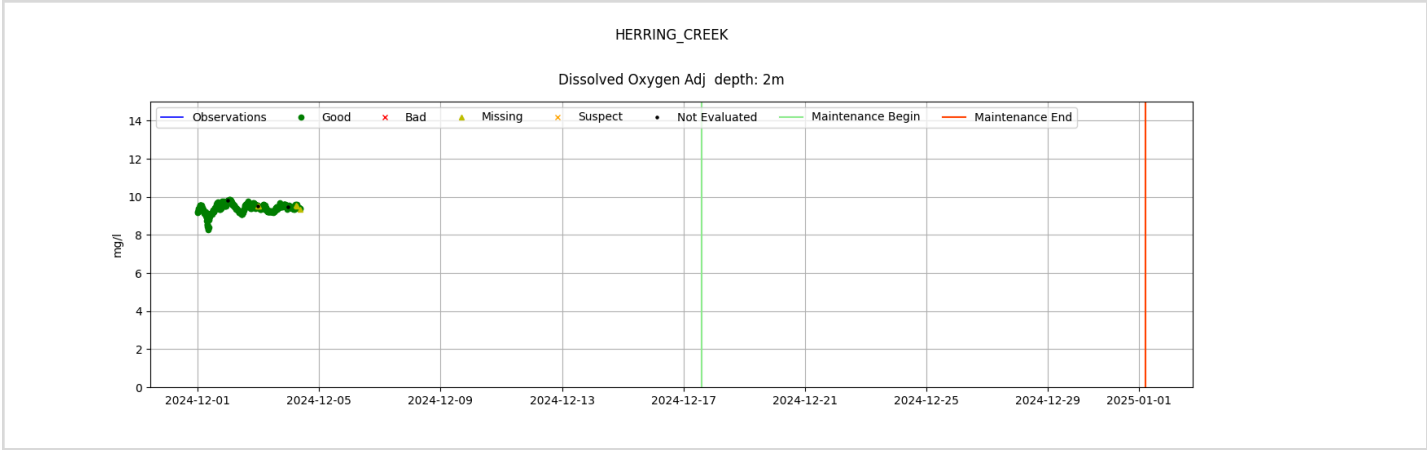




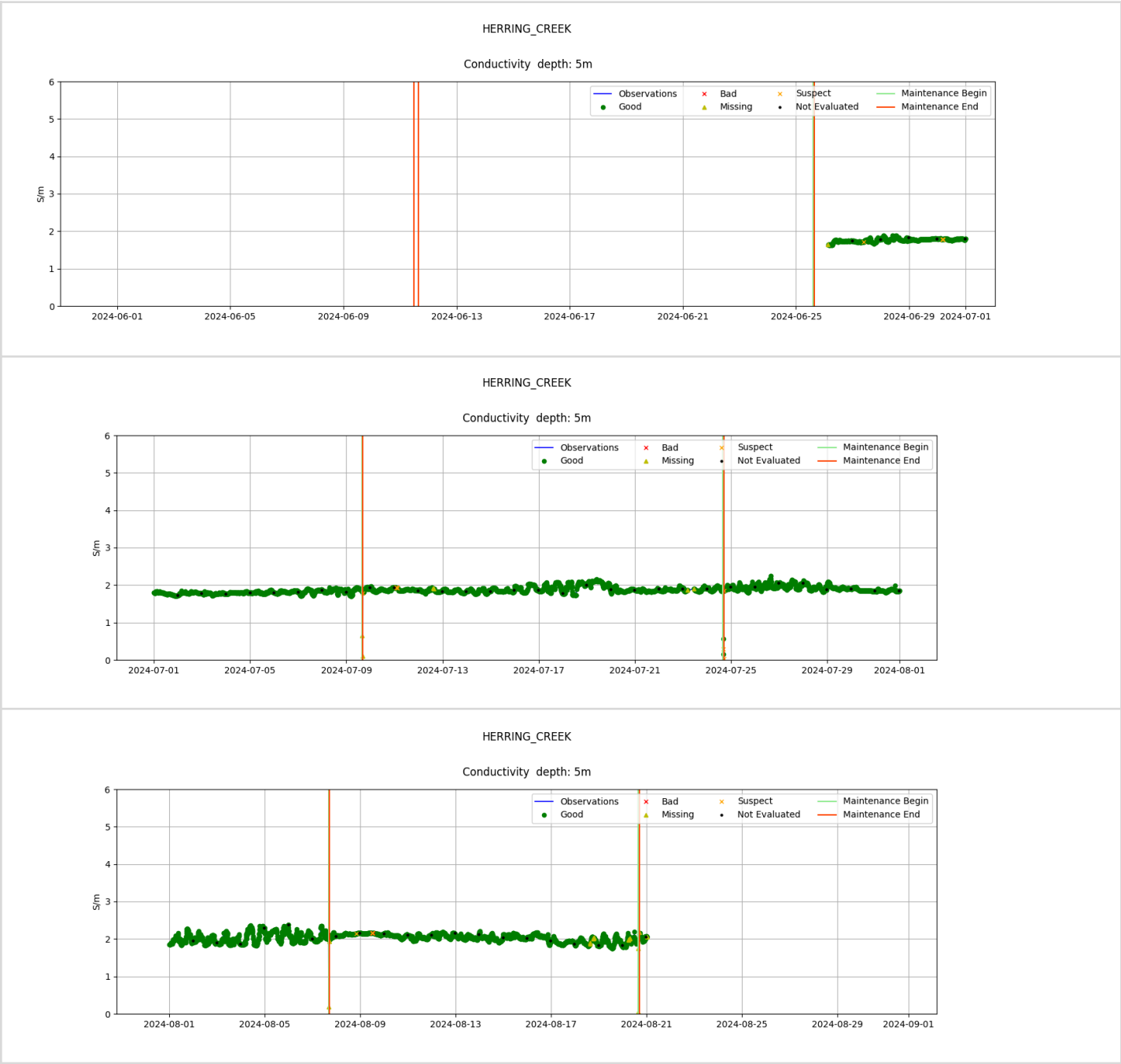
Herring Creek 2m Dissolved Oxygen Adjusted

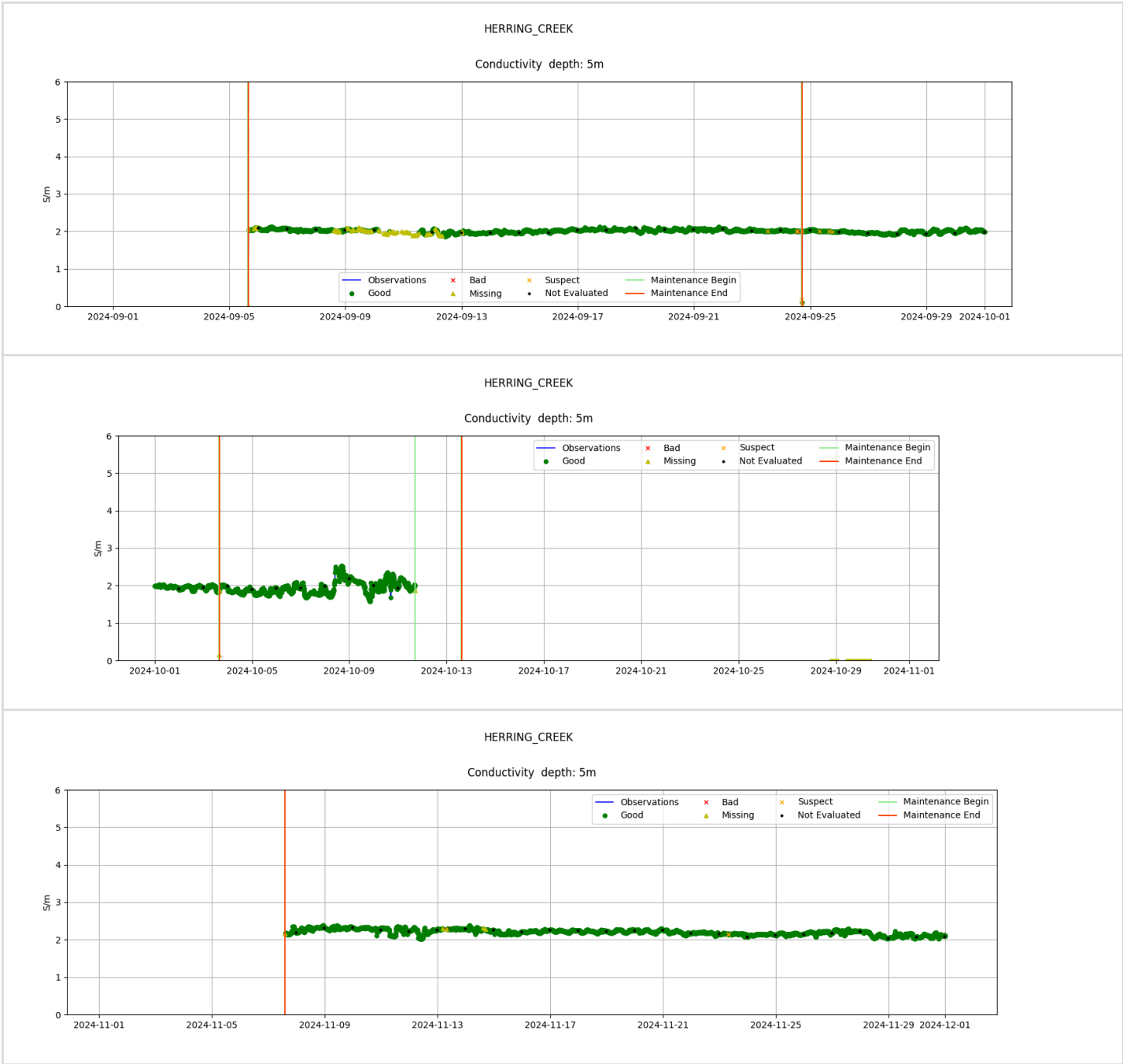


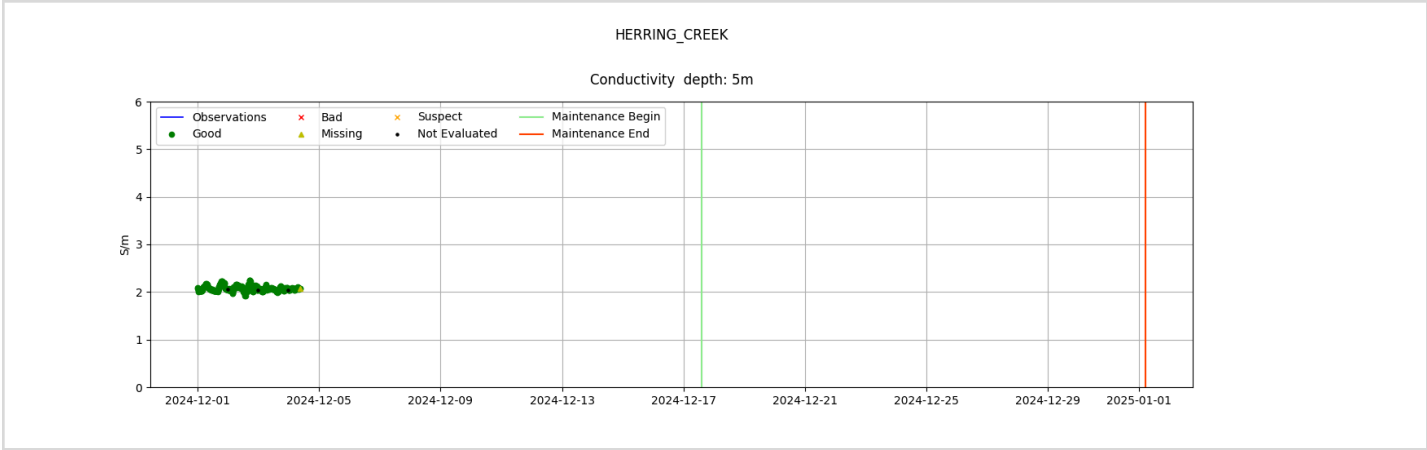




Herring Creek 5m Conductivity

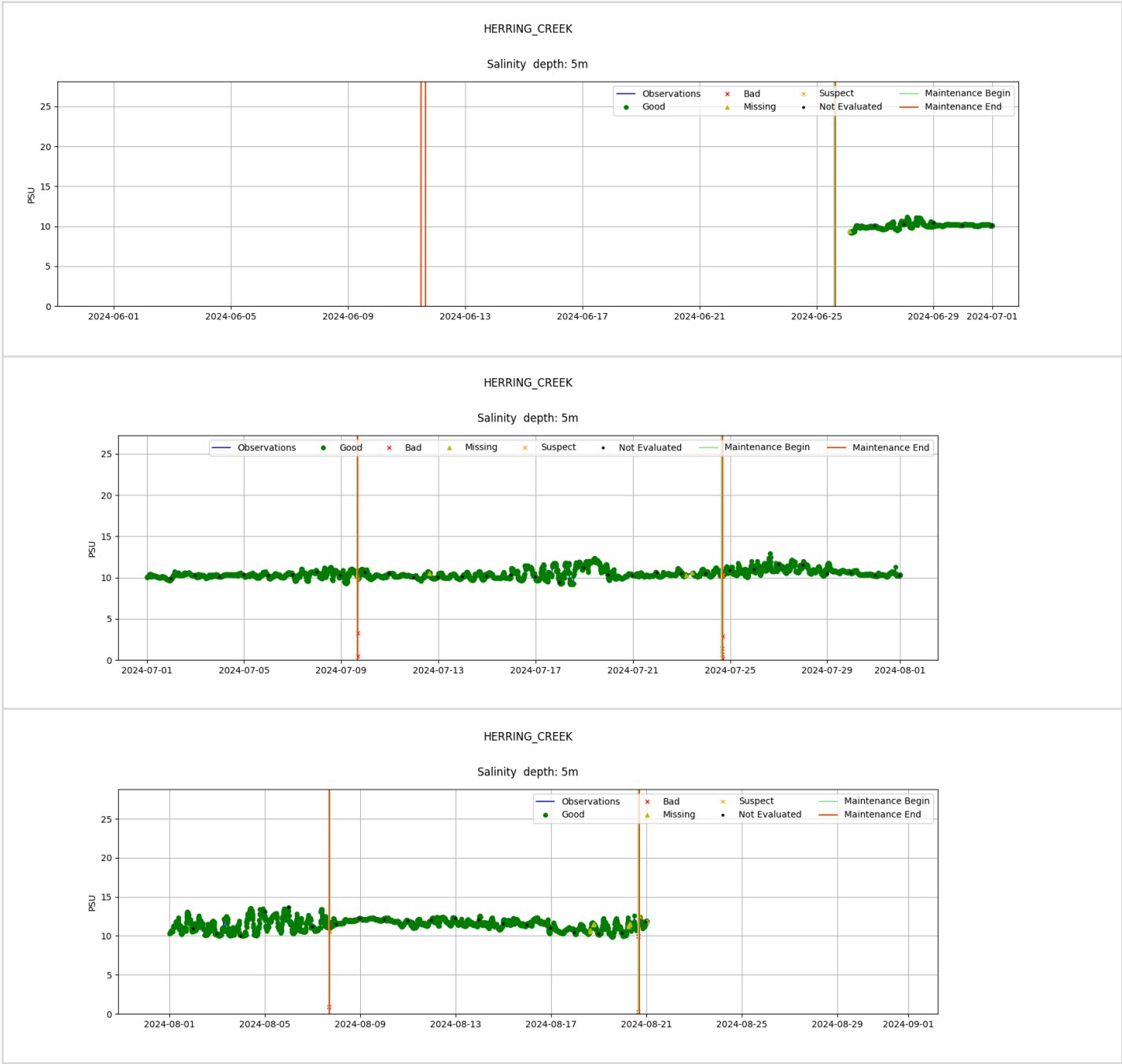


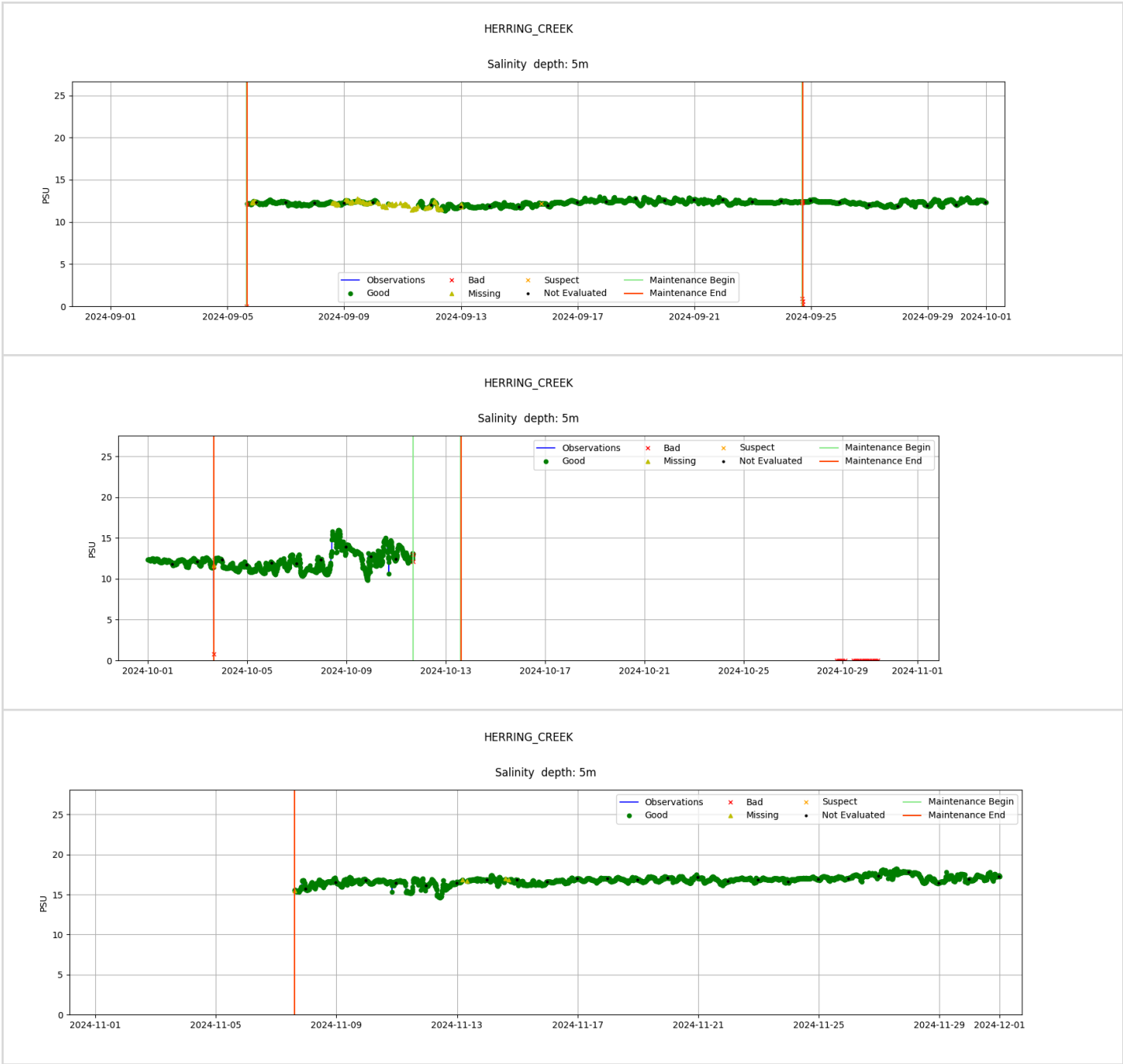


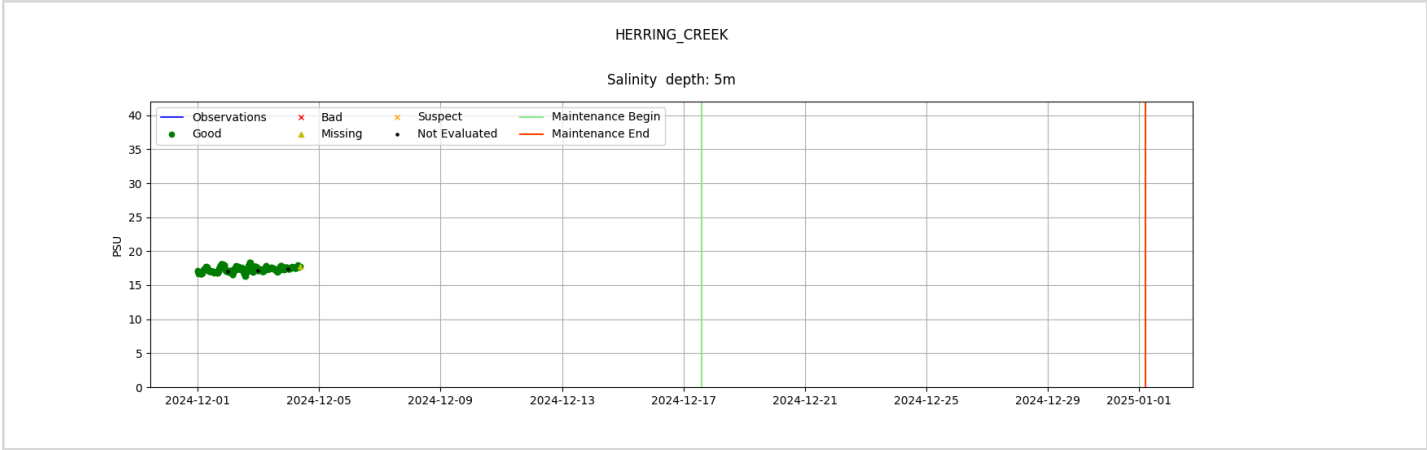




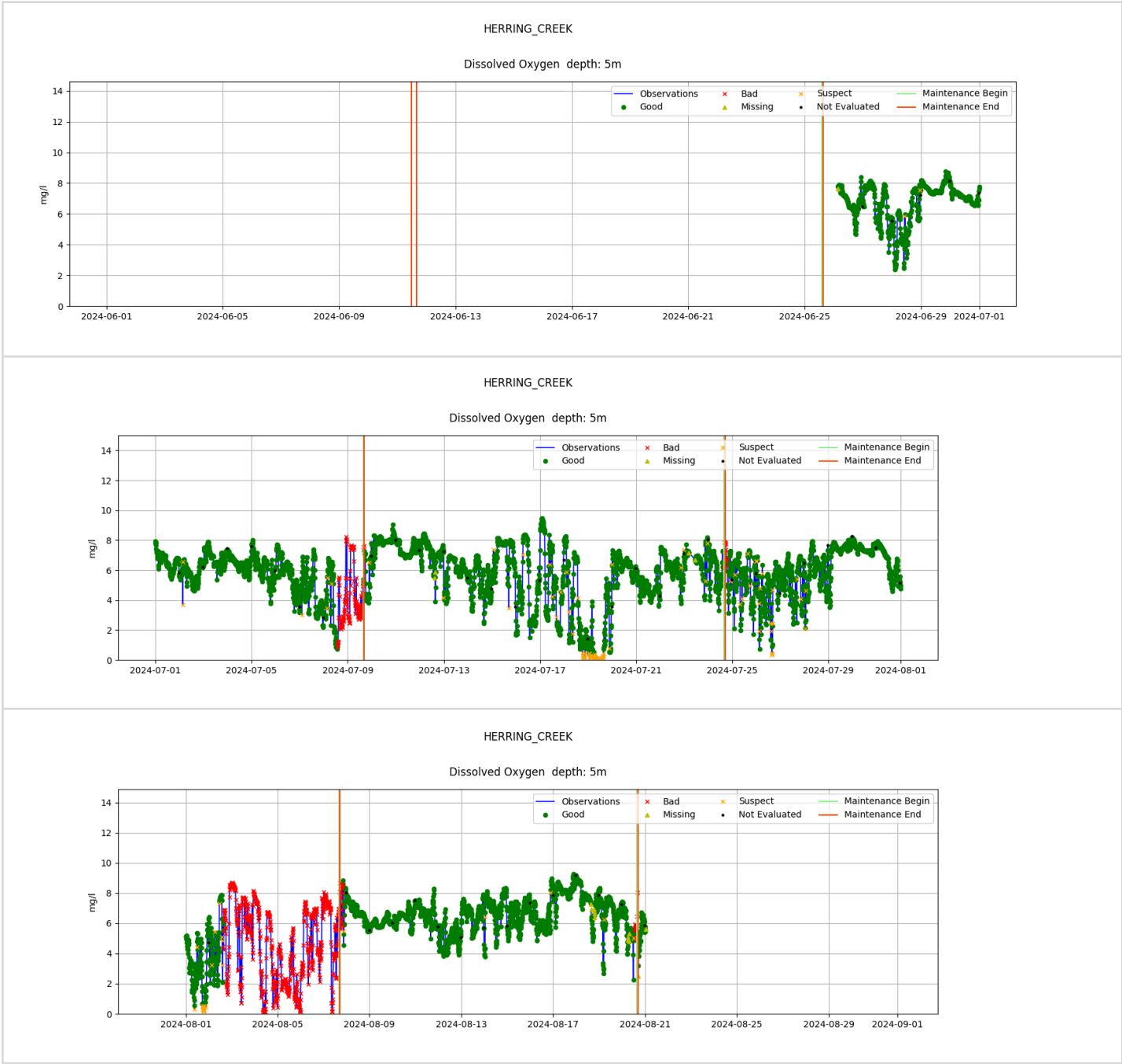
Herring Creek 5m Salinity

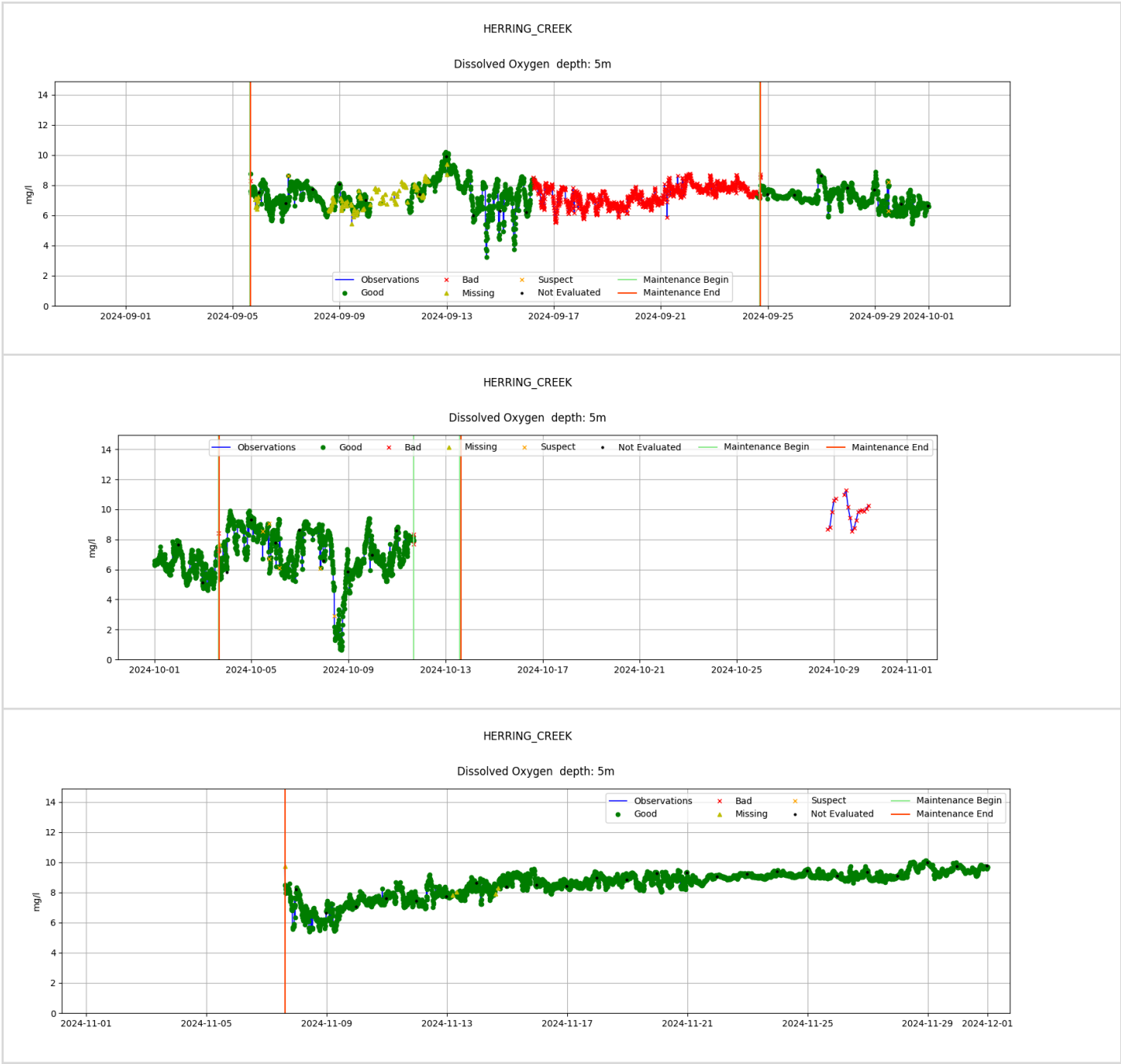


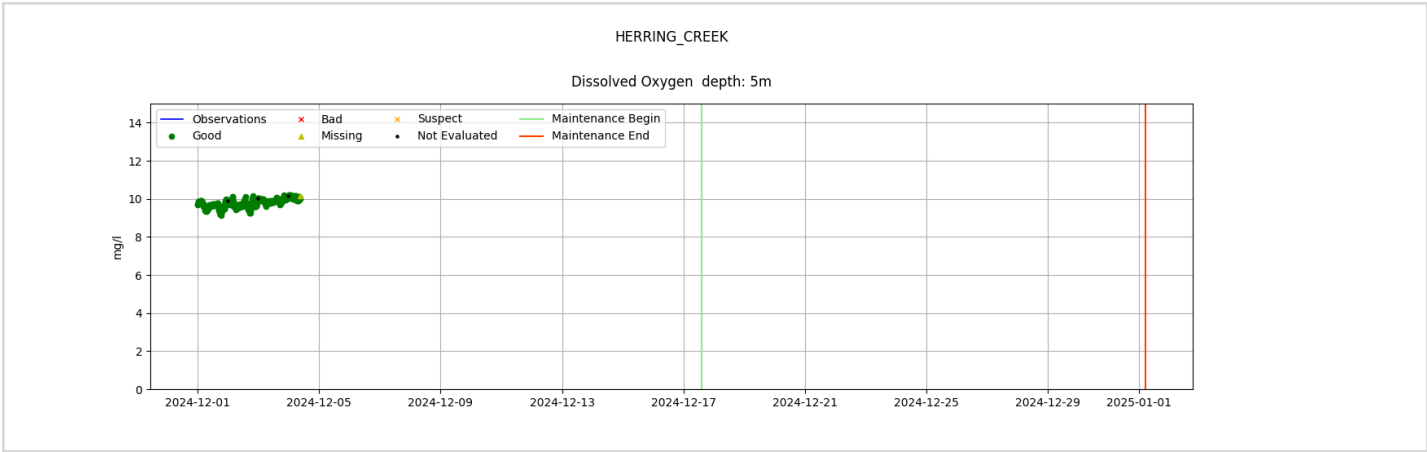




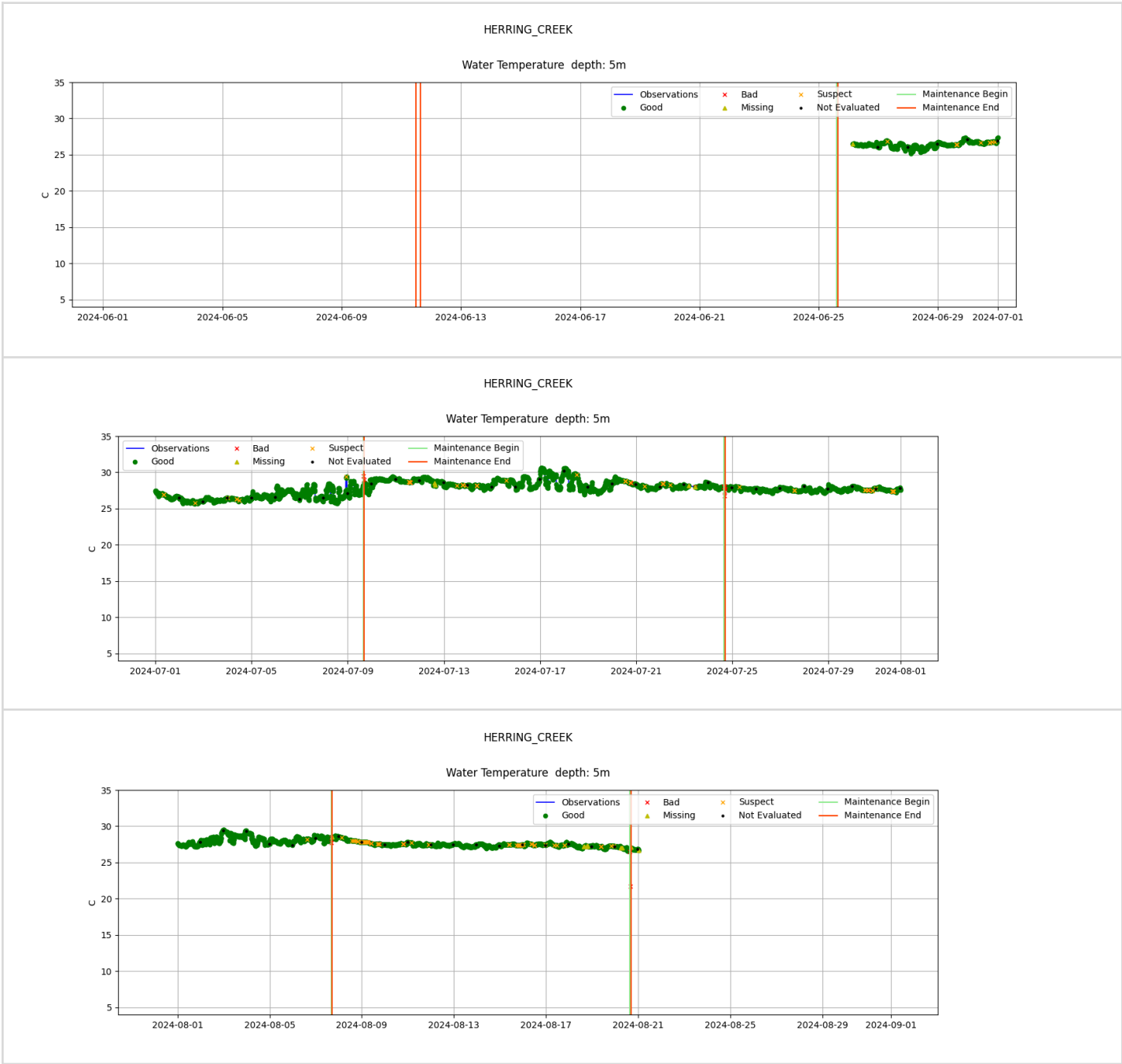
Herring Creek 5m Dissolved Oxygen

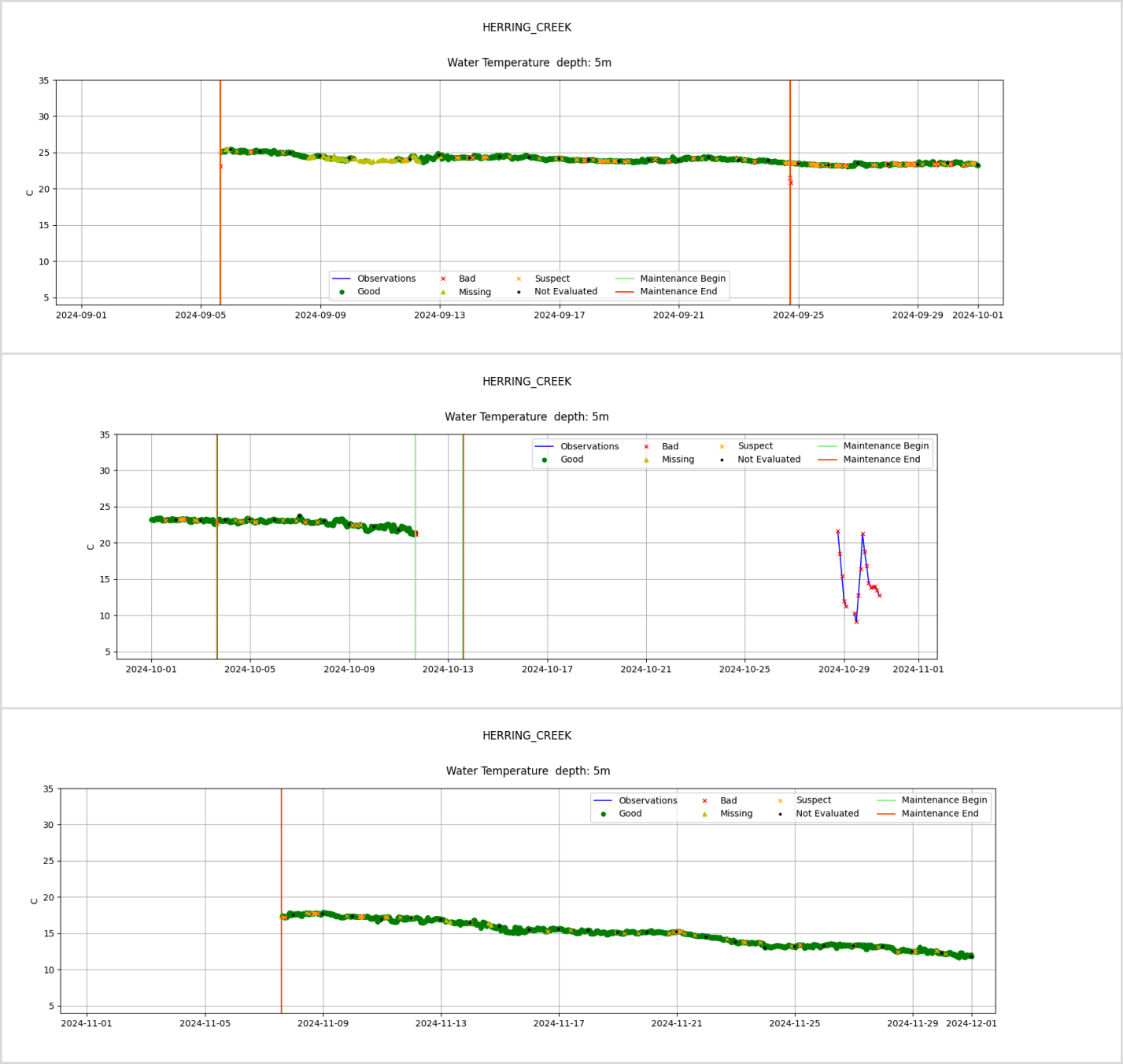




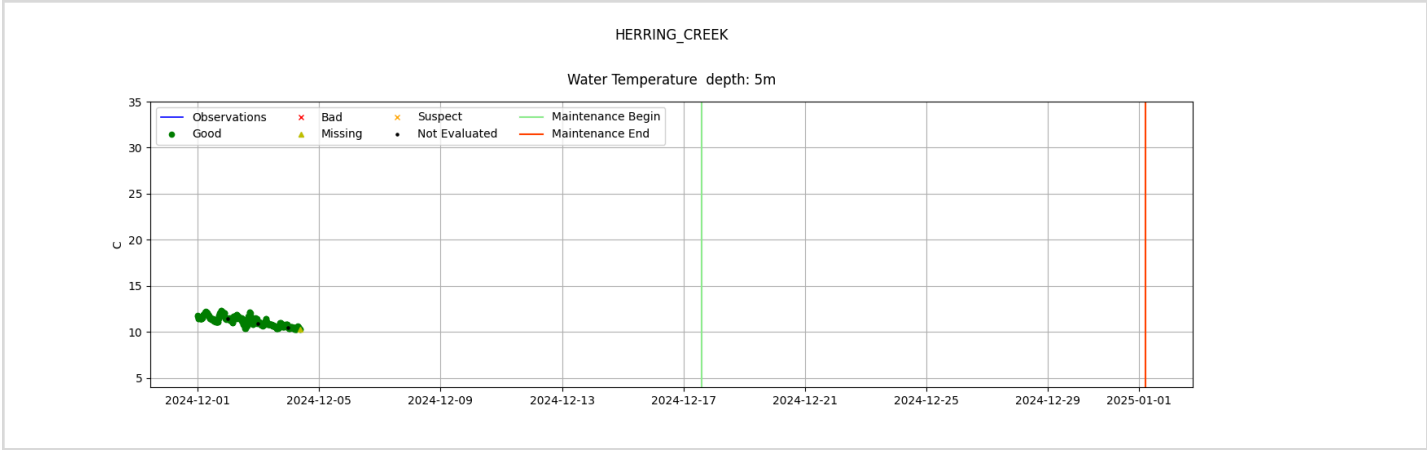


Herring Creek 5m Water Temperature

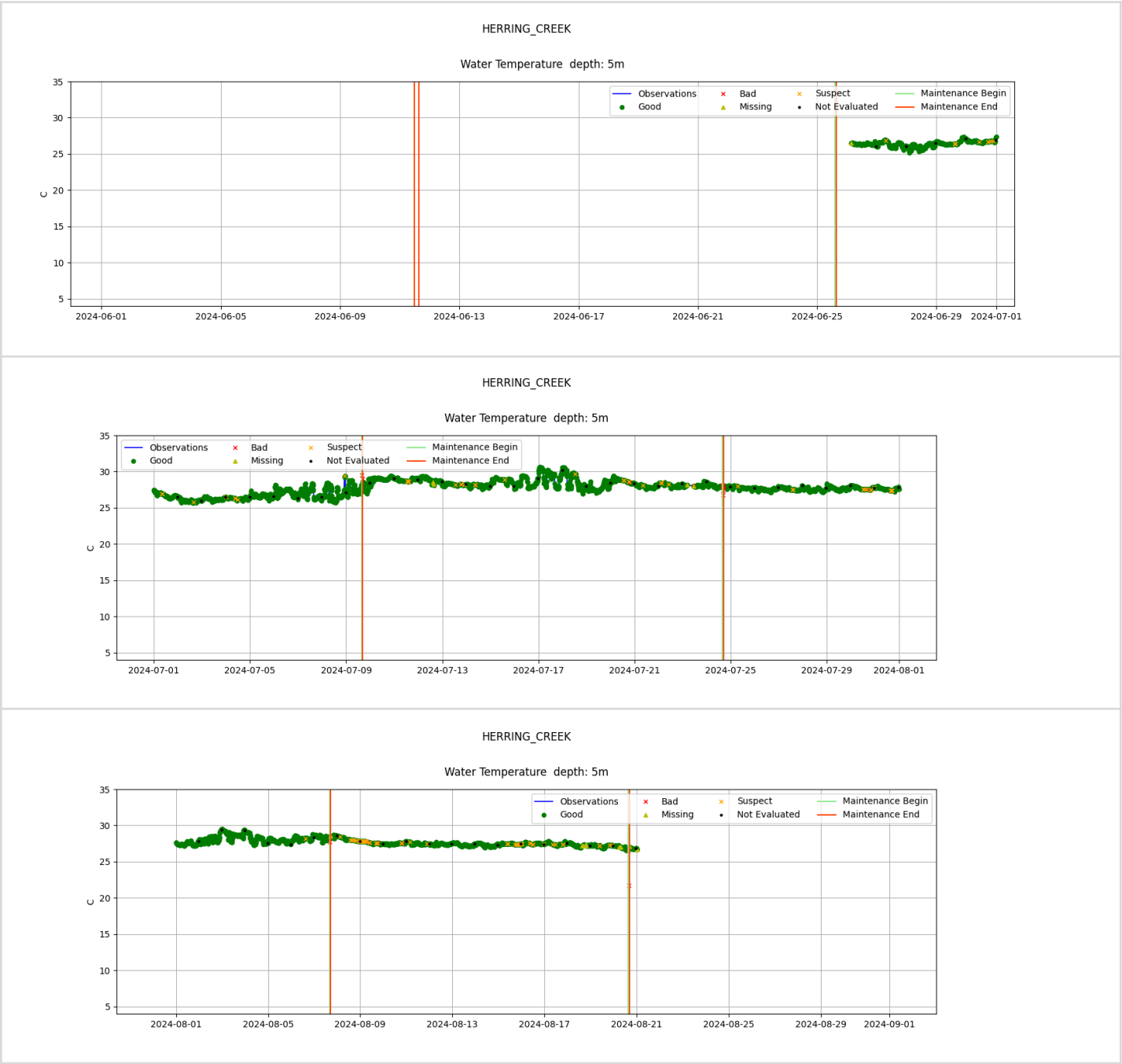


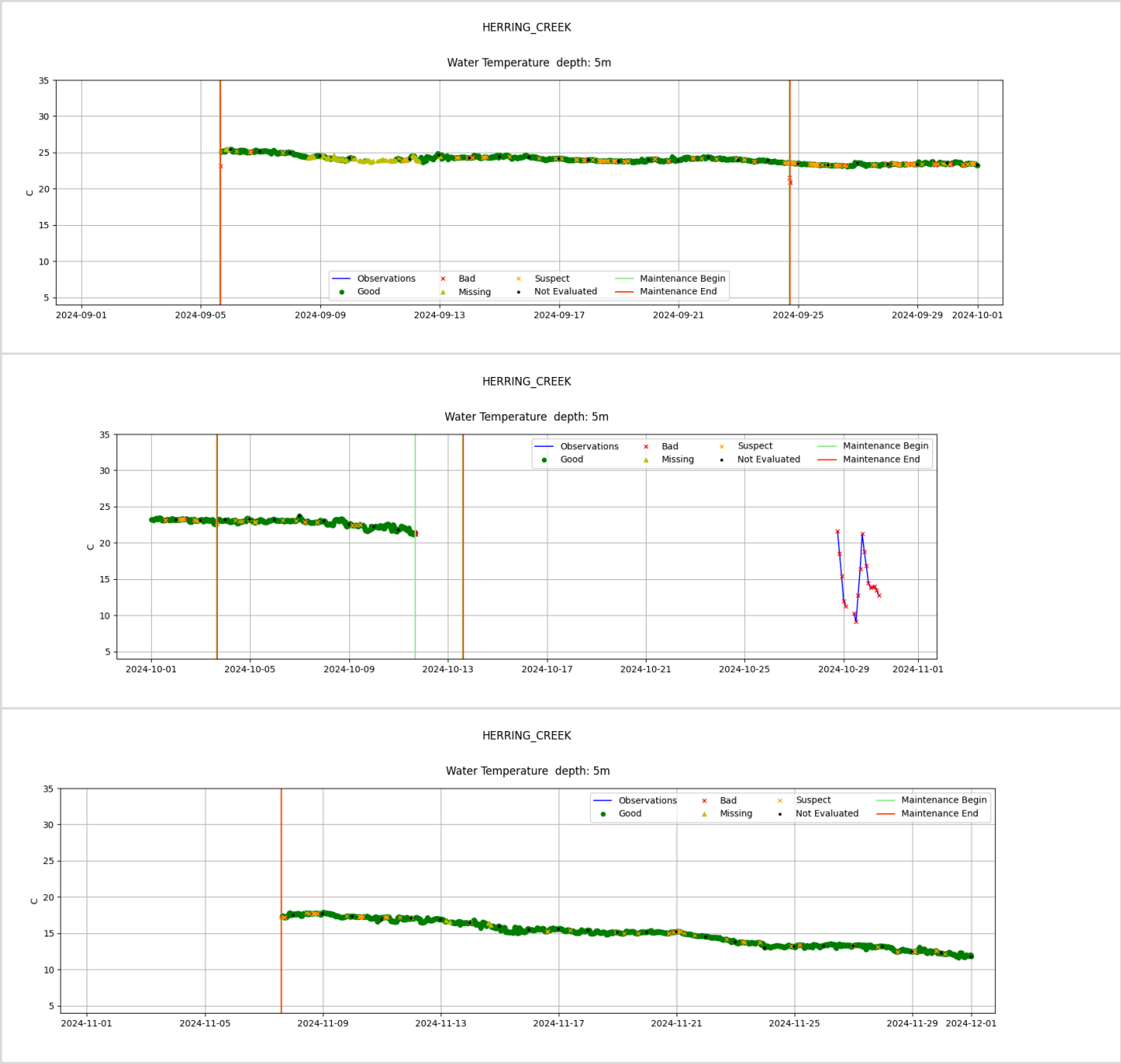


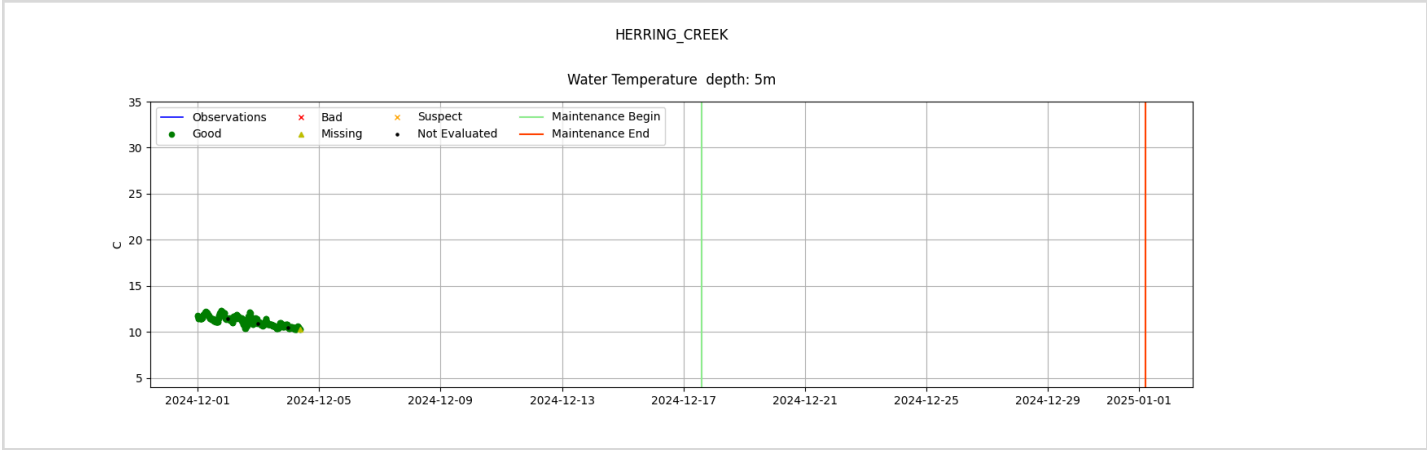




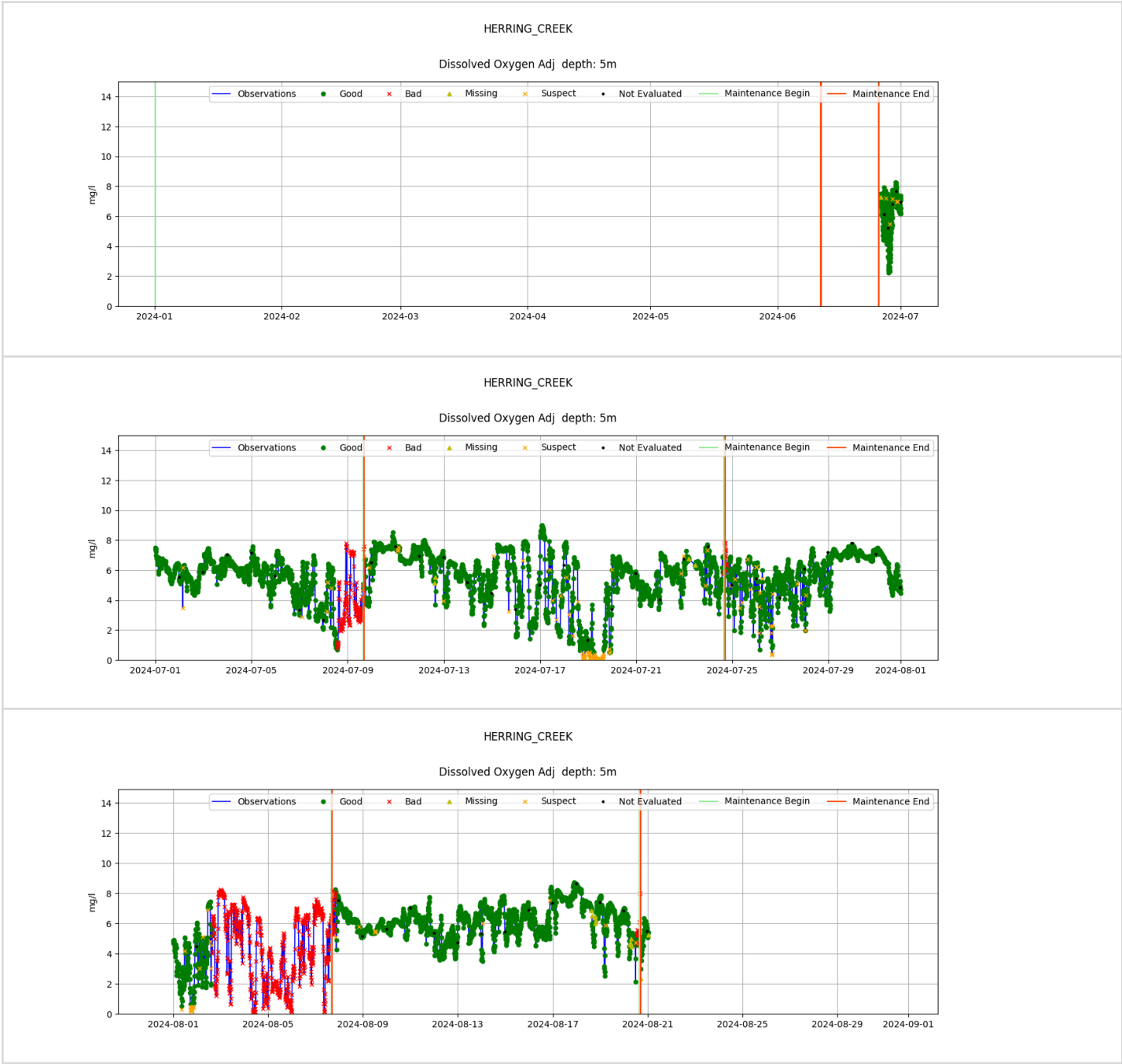
Herring Creek 5m Water Temperature

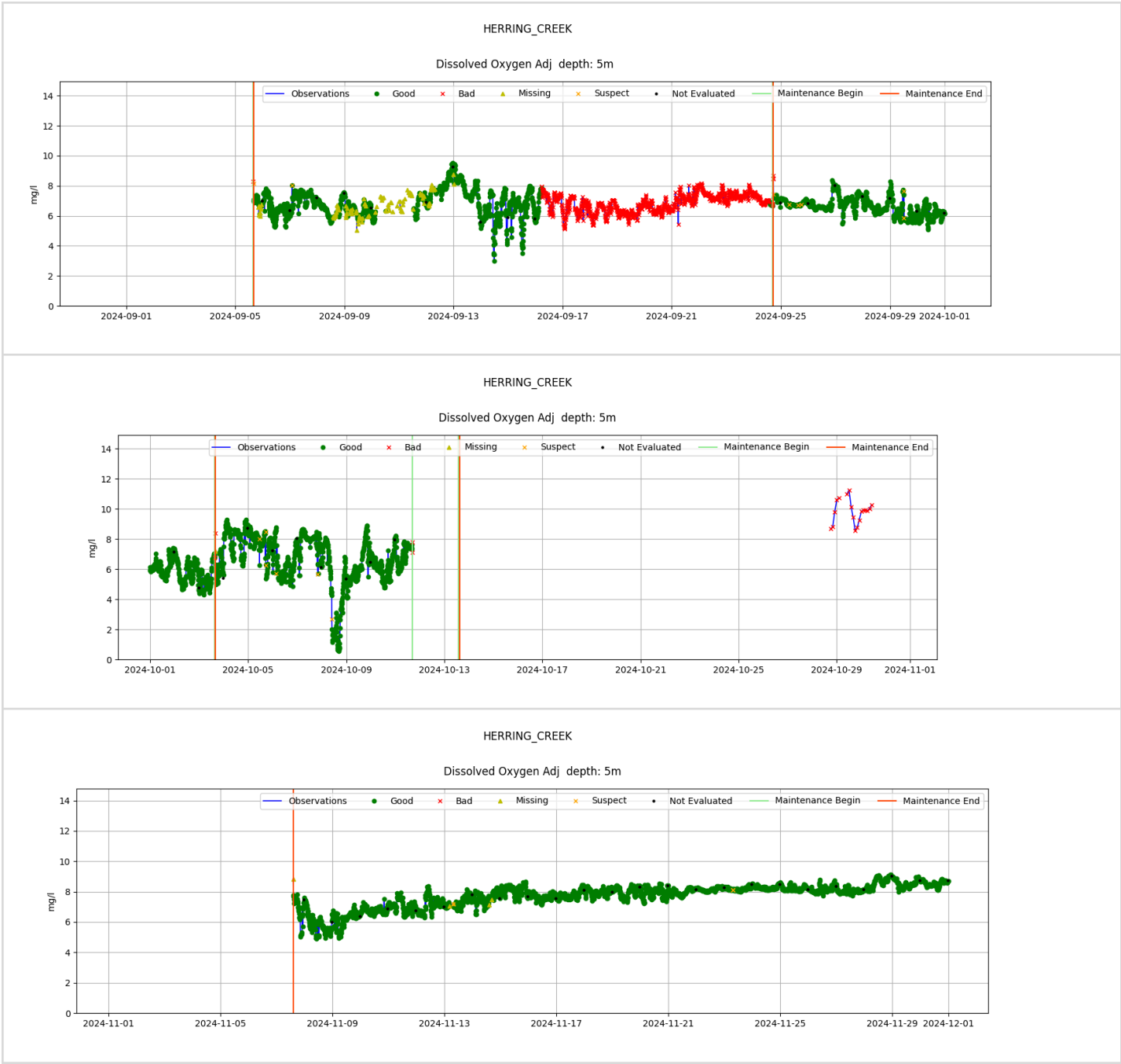


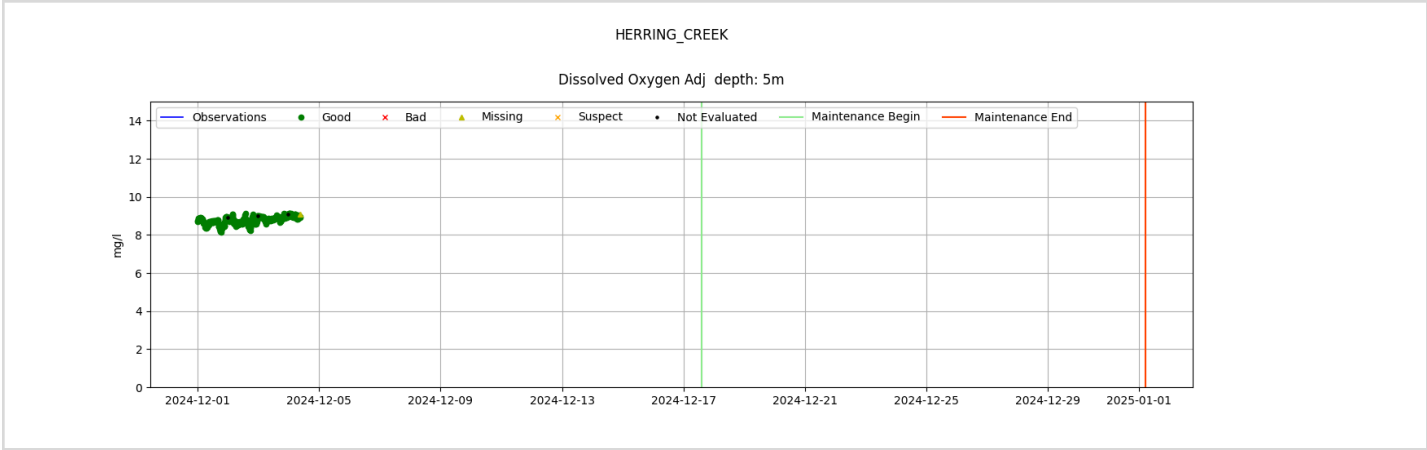




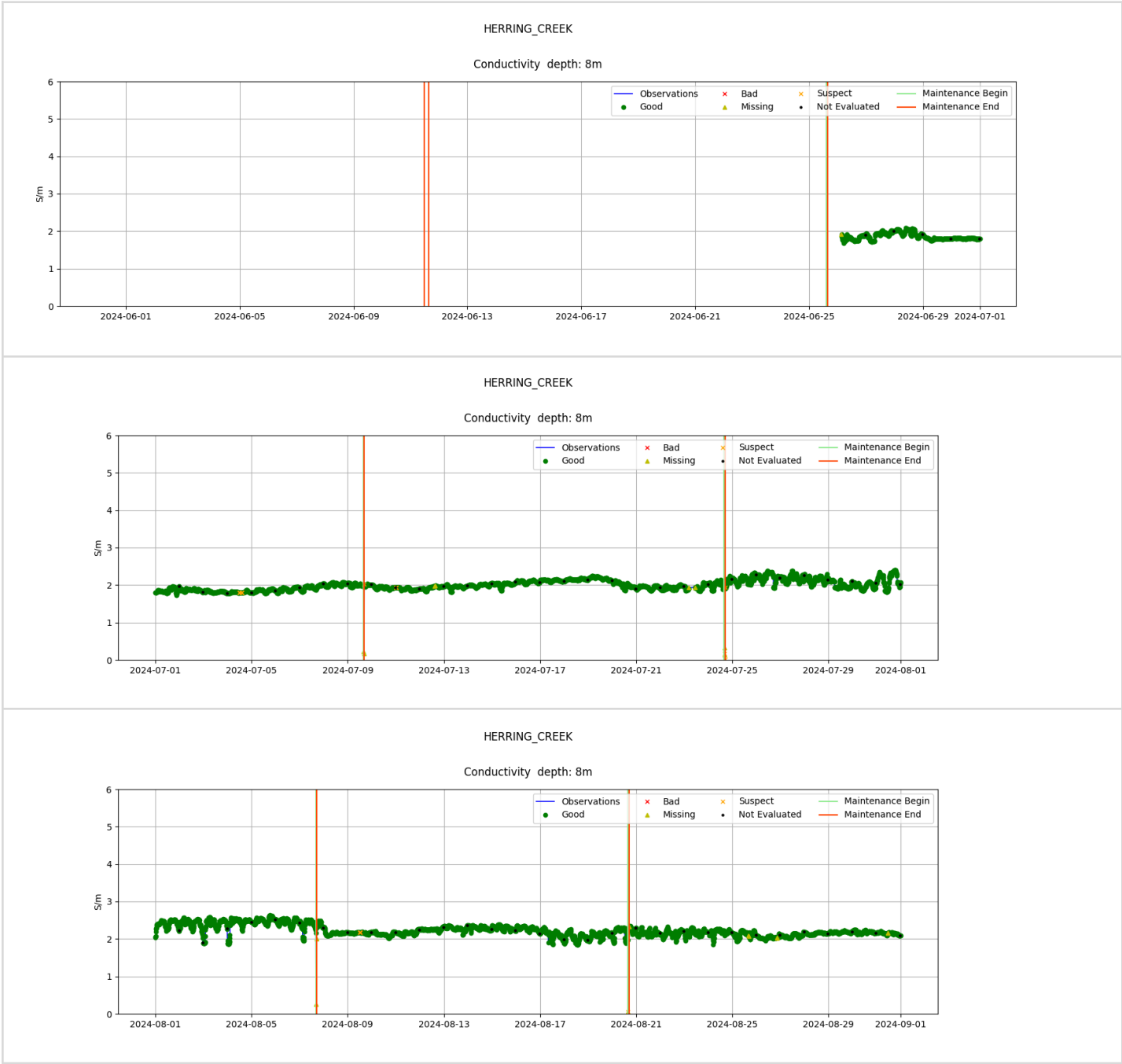
Herring Creek 5m Dissolved Oxygen Adjusted





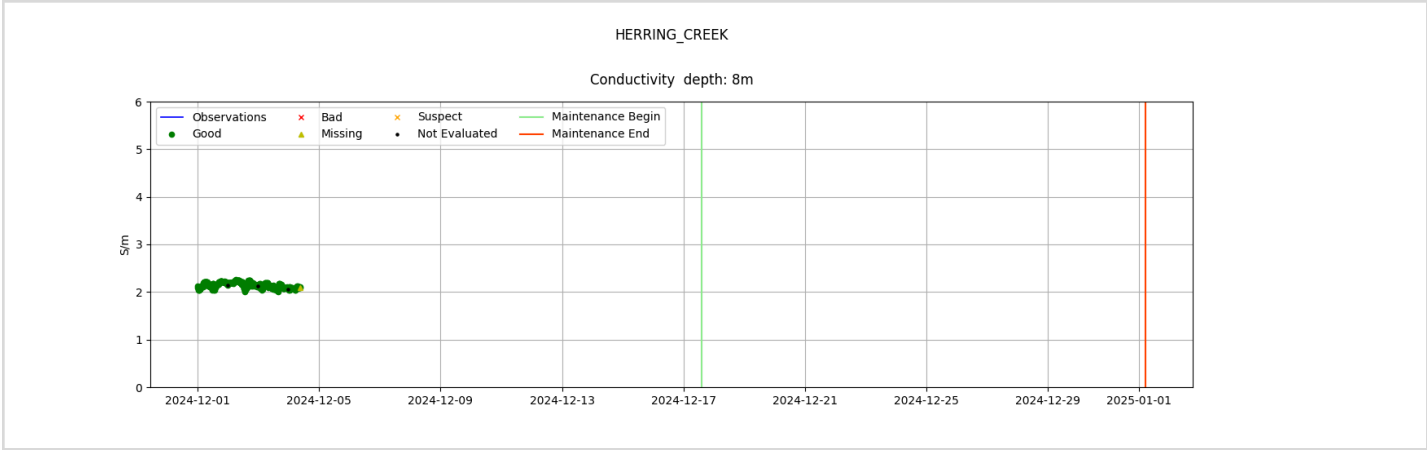


Herring Creek 8m Conductivity

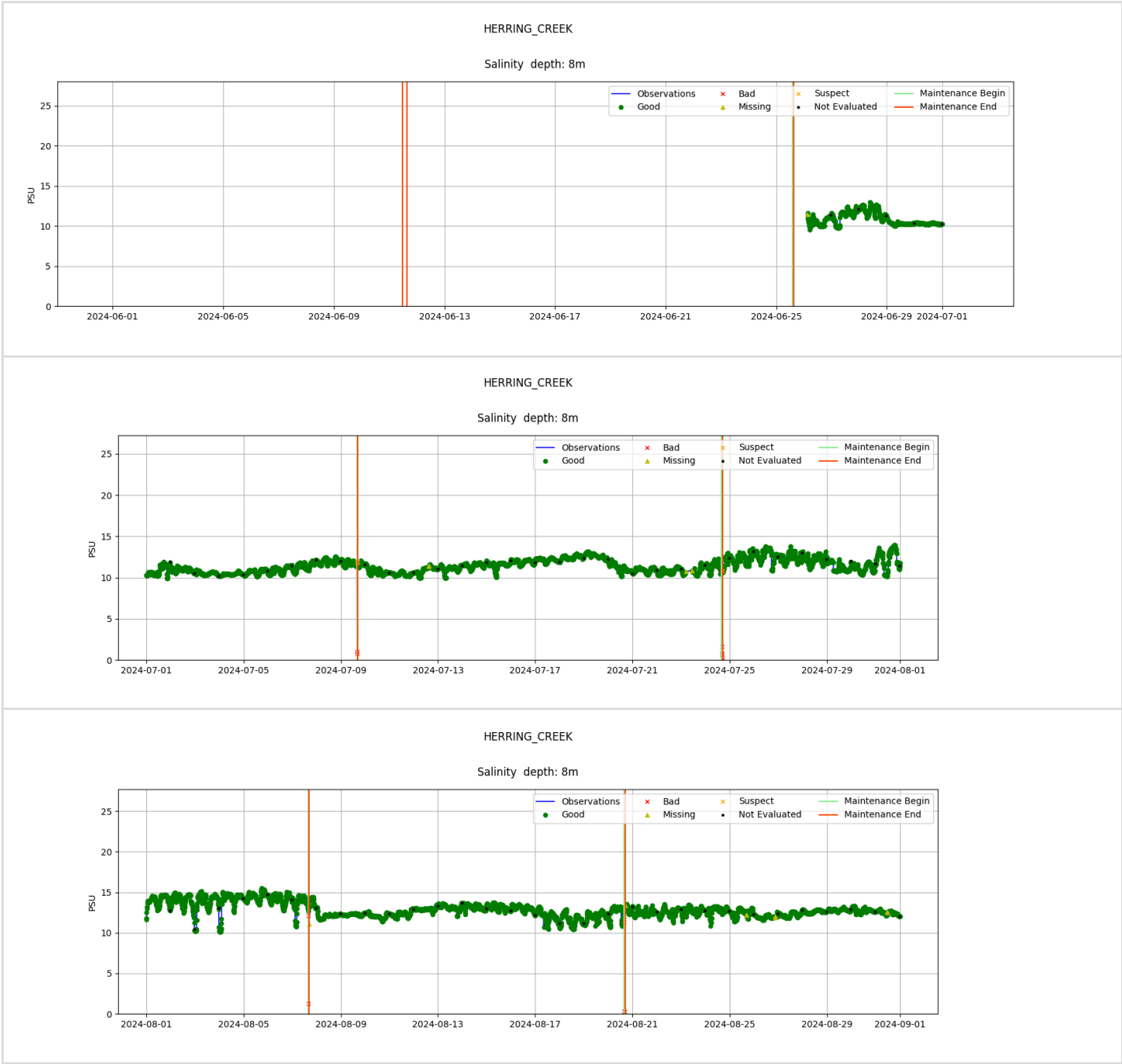


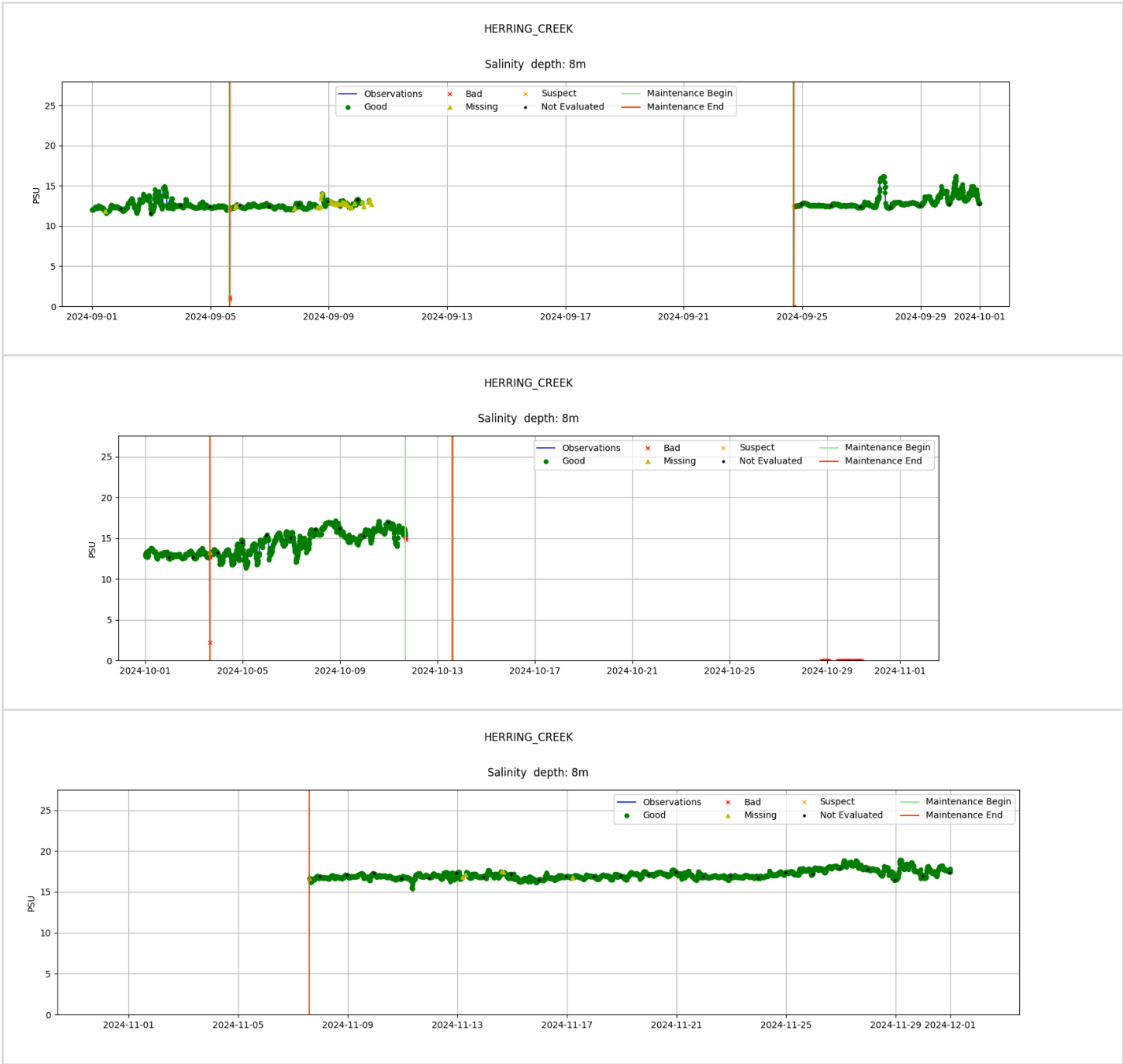


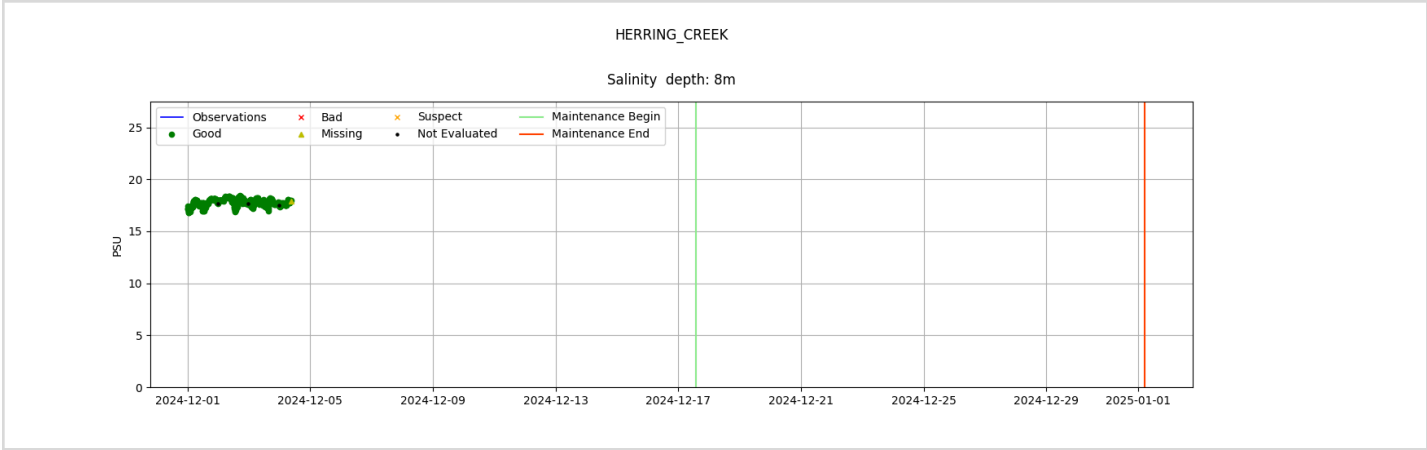




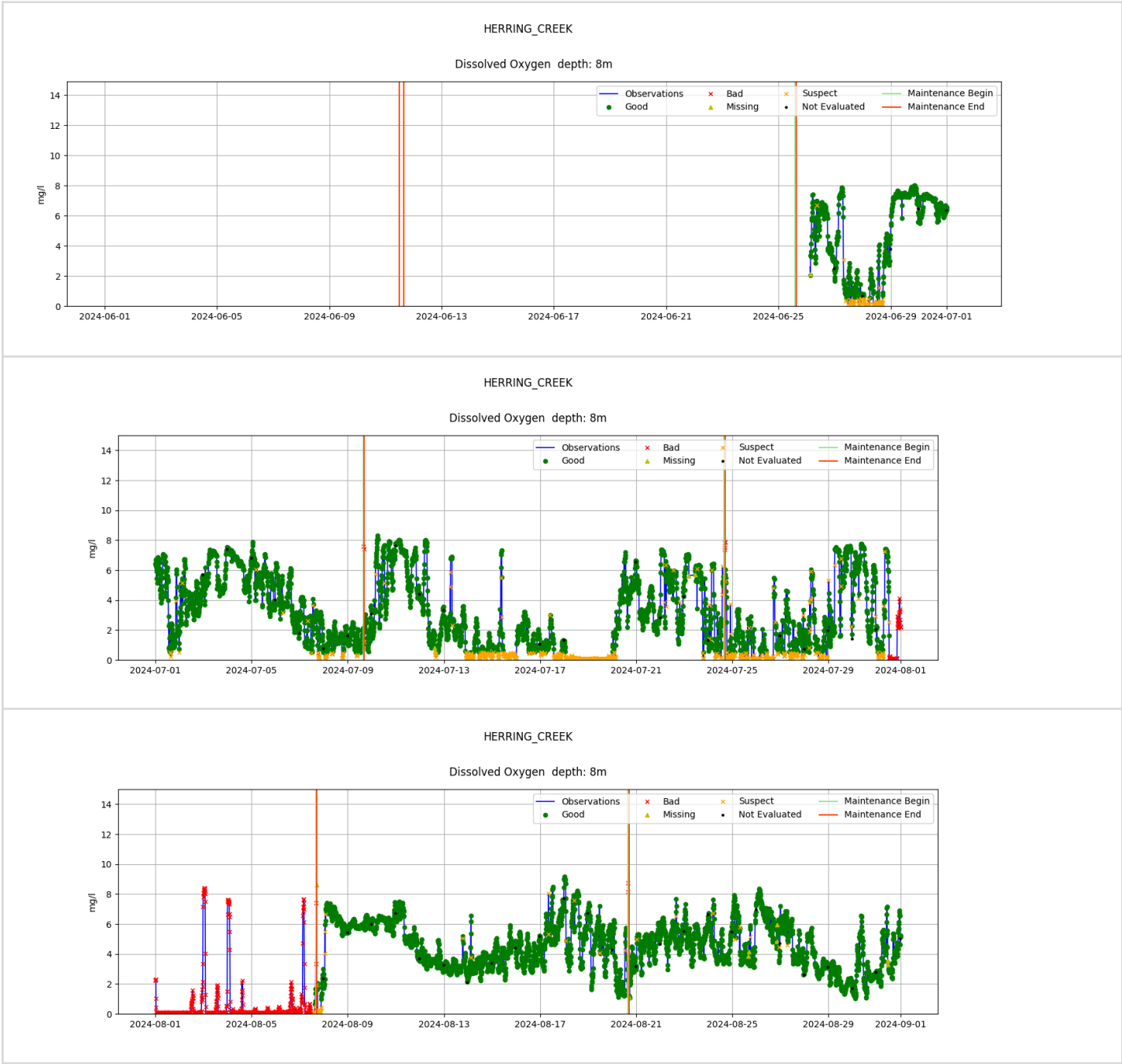
Herring Creek 8m Salinity

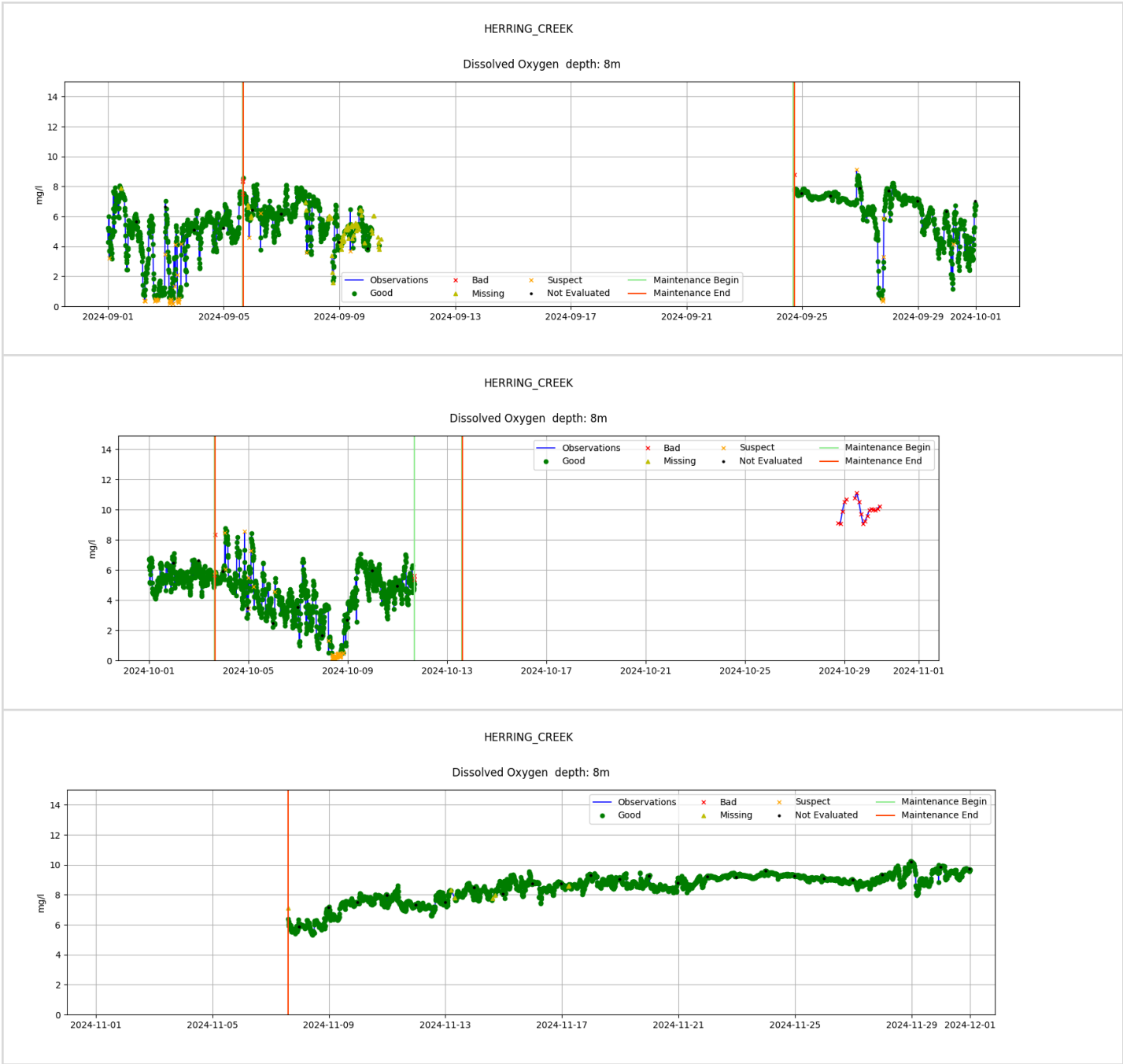


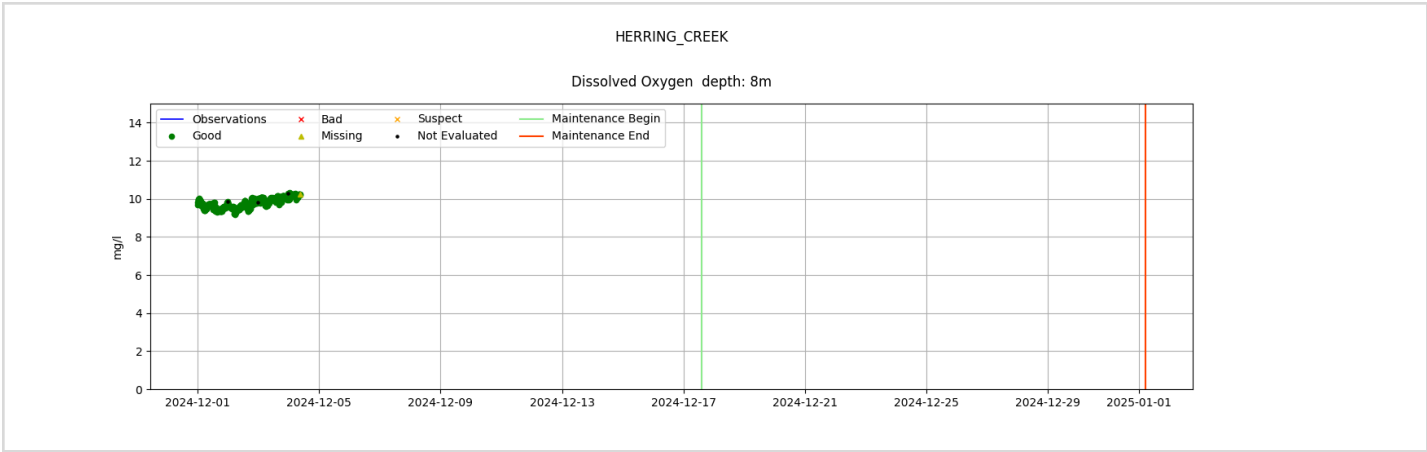




Herring Creek 8m Dissolved Oxygen



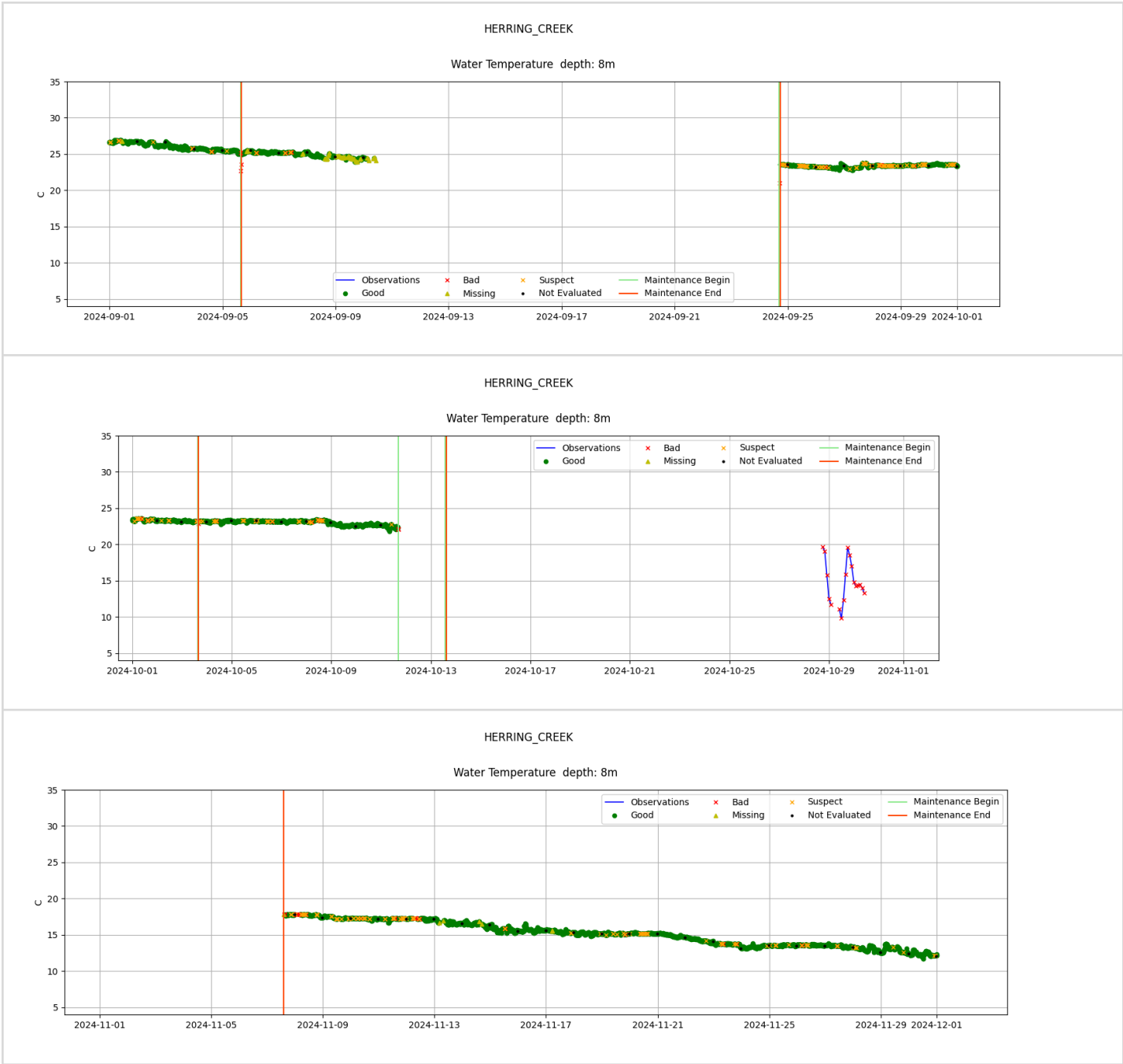


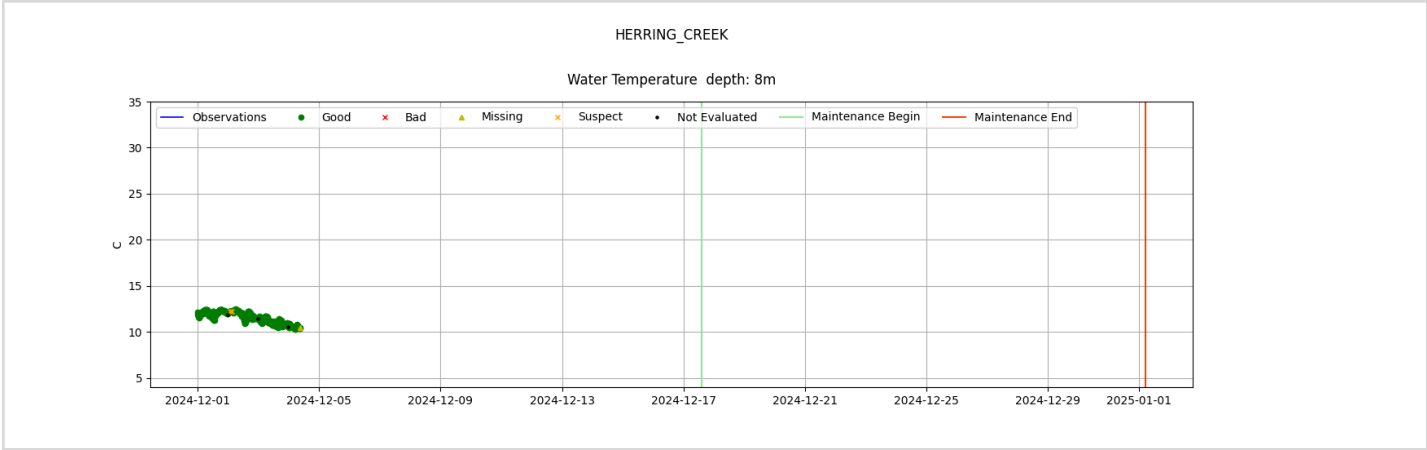




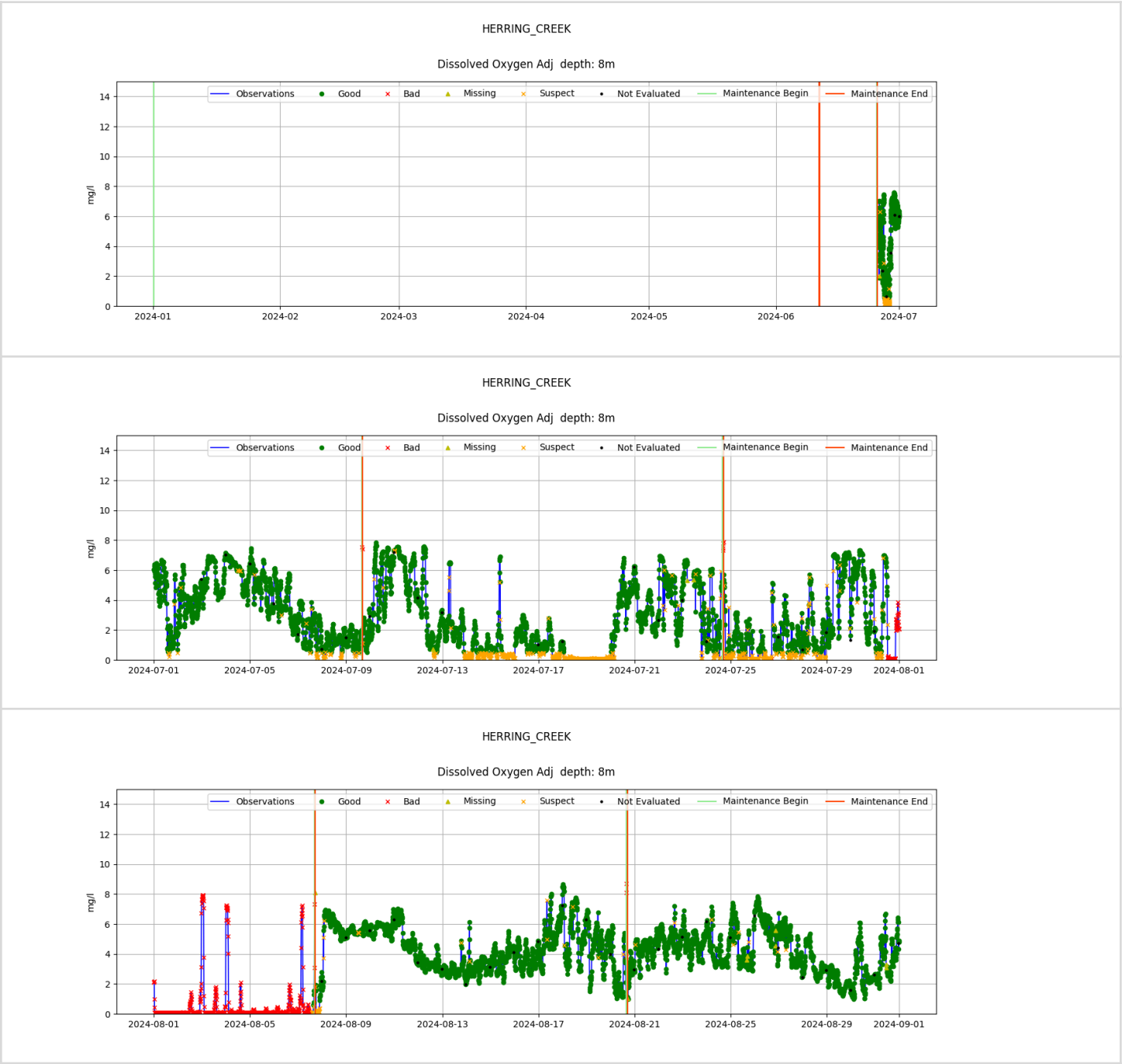
Herring Creek 8m Water Temperature

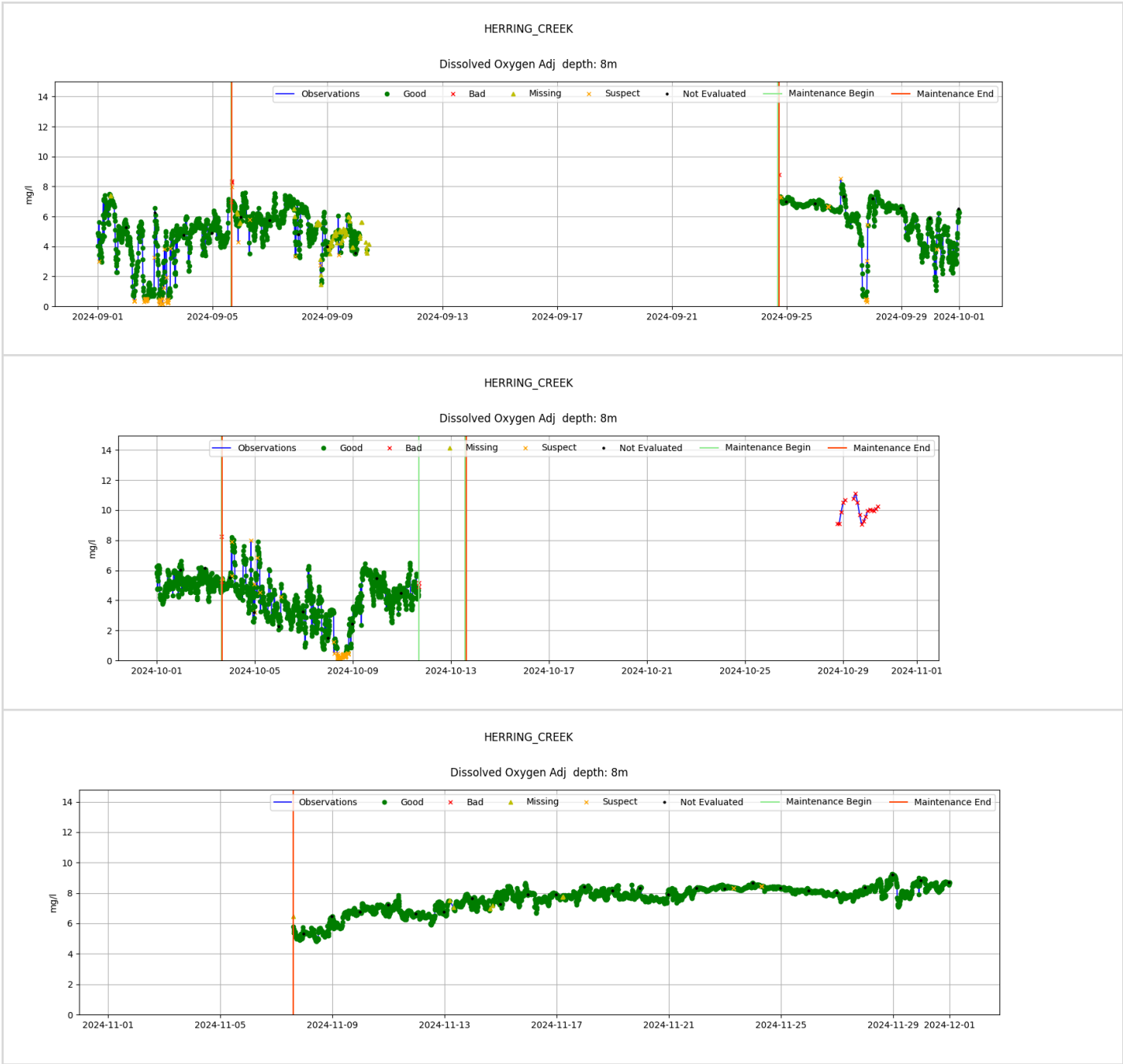


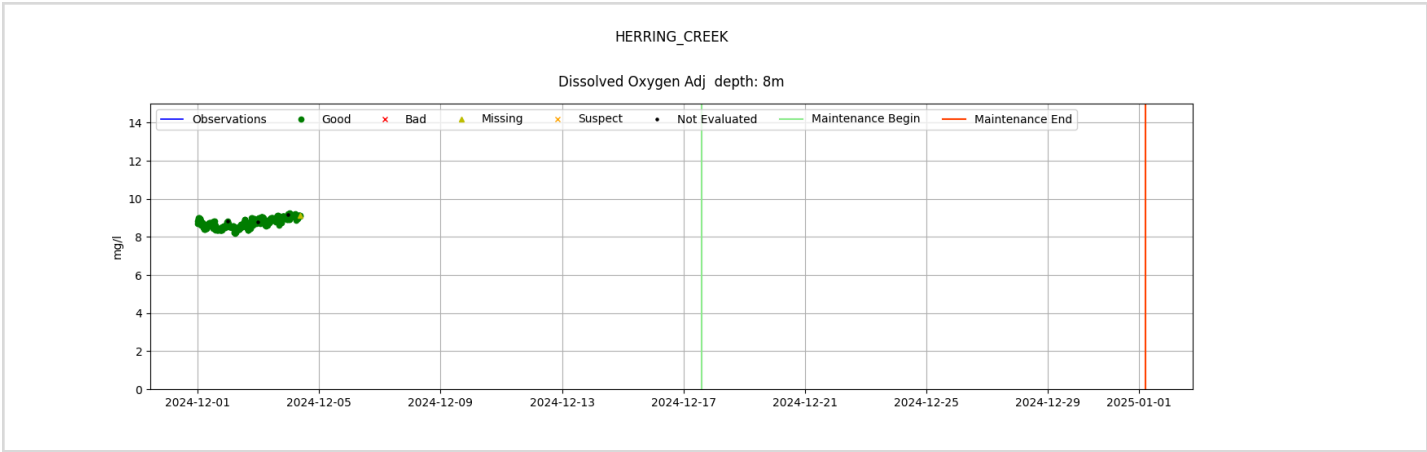




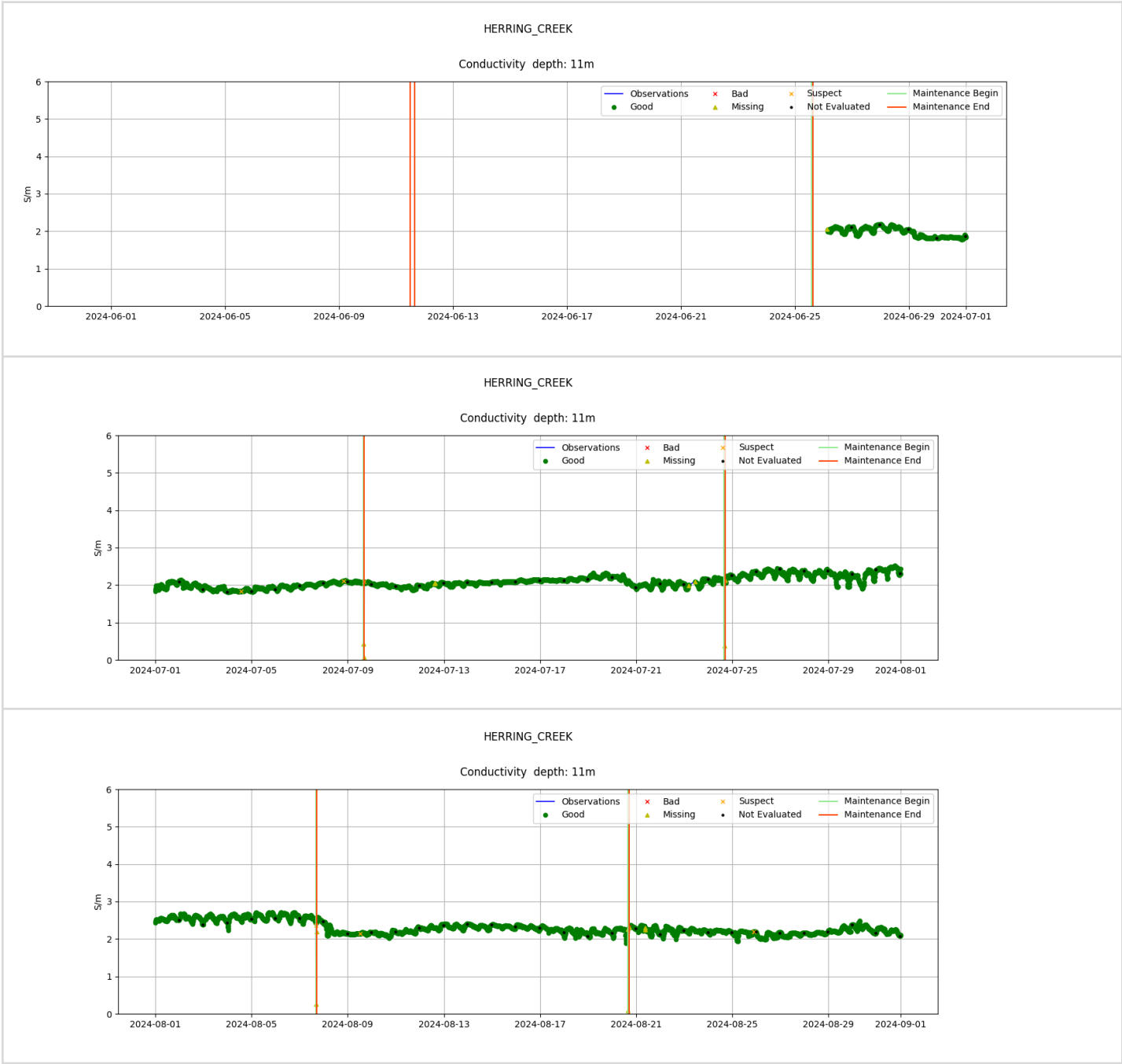
Herring Creek 8m Dissolved Oxygen Adjusted

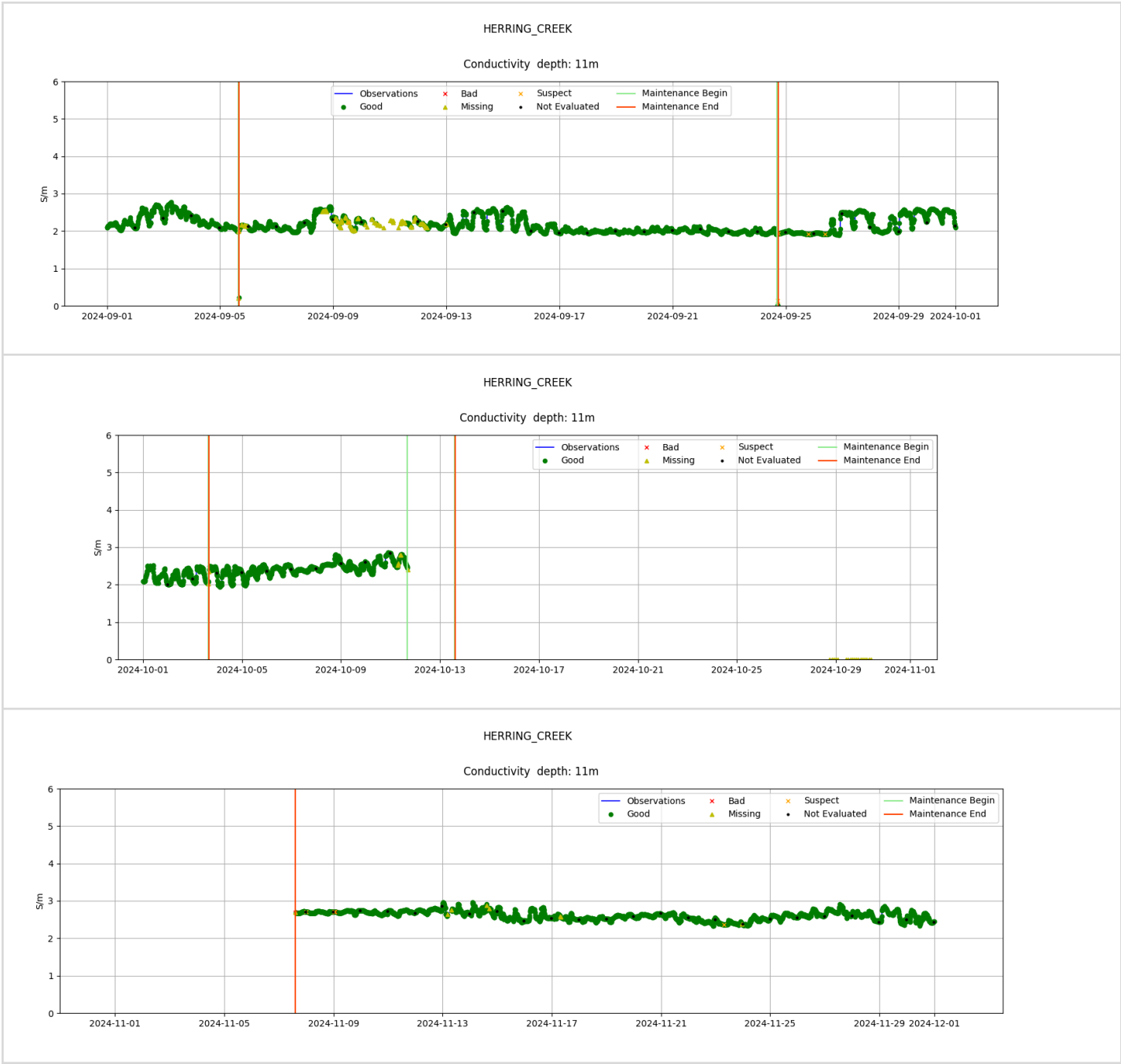




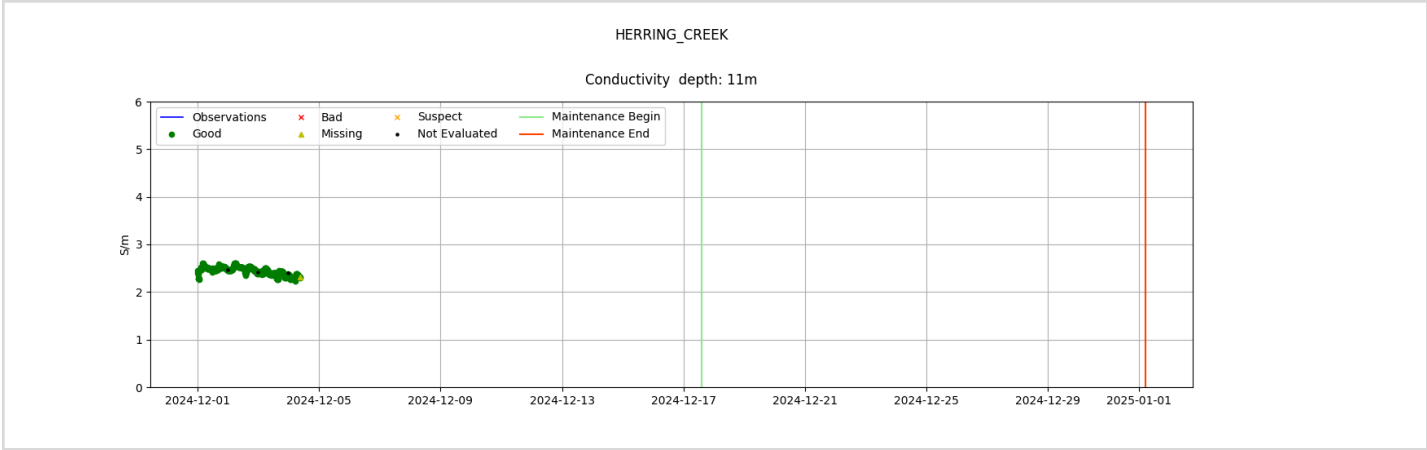


Herring Creek 11m Conductivity

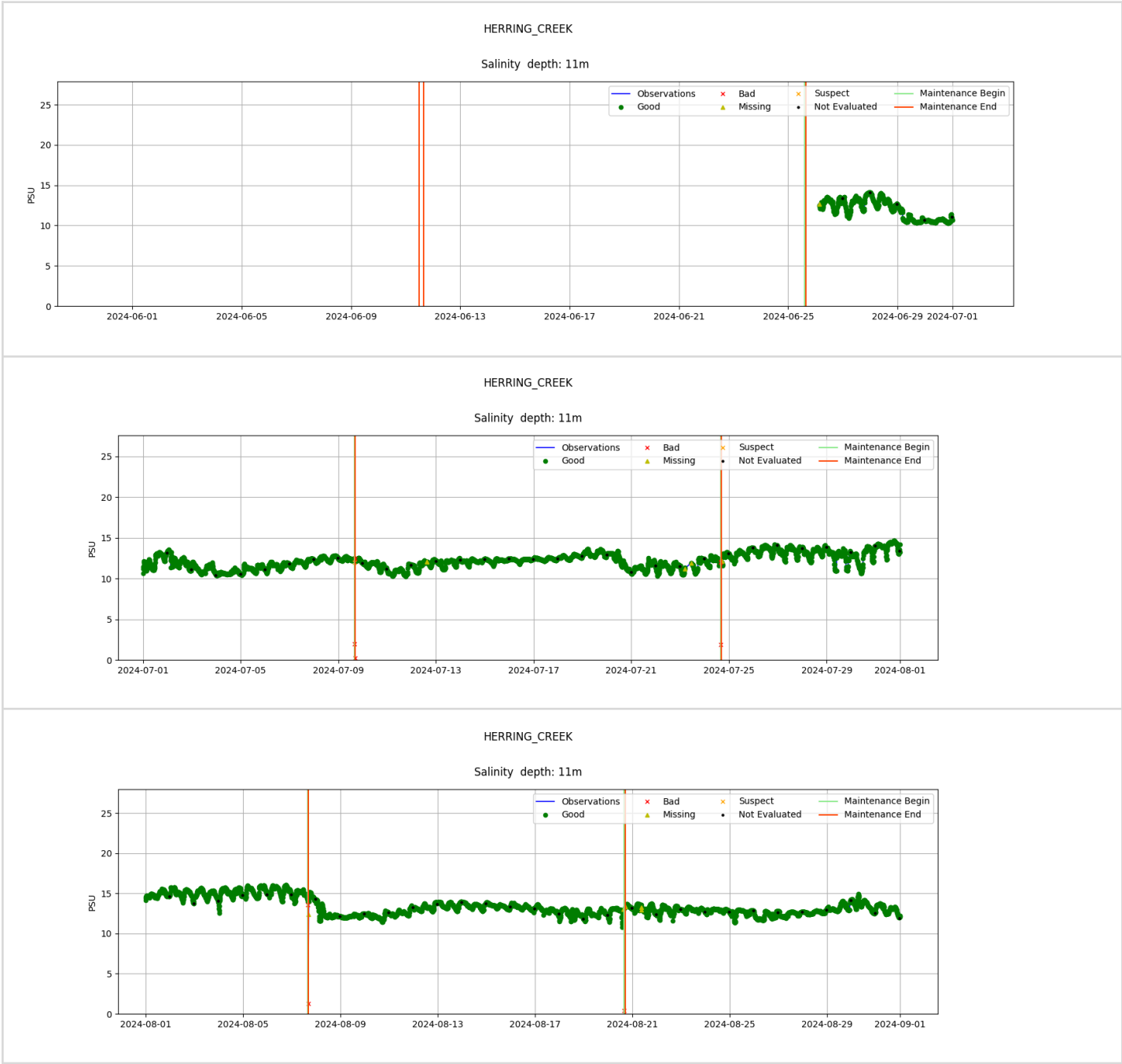


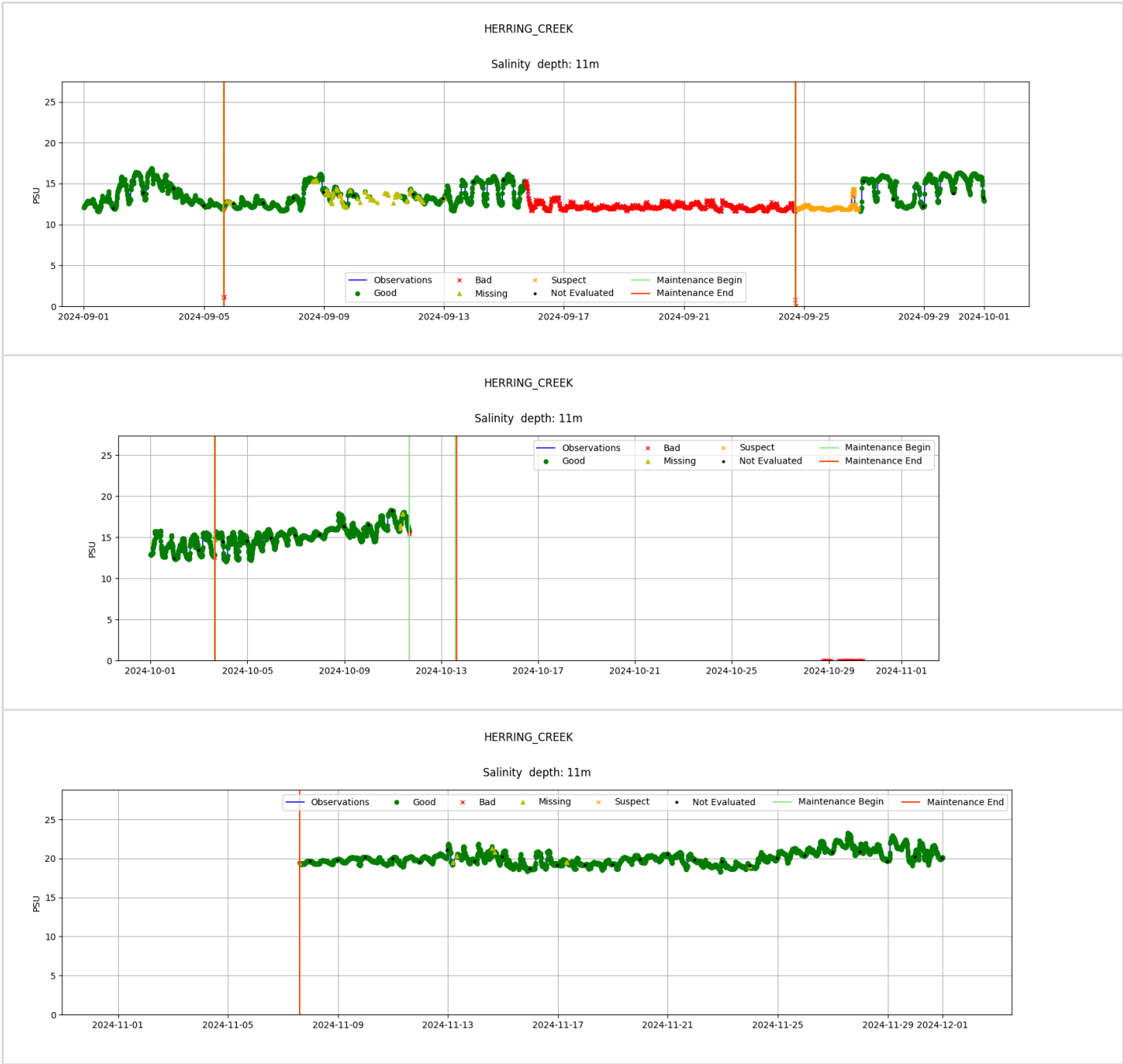


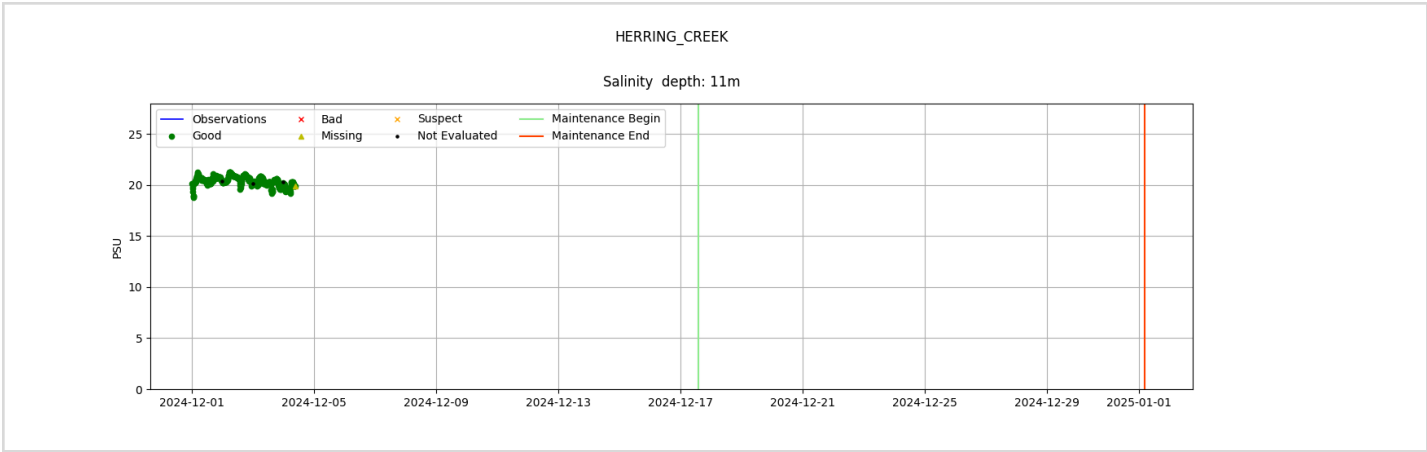




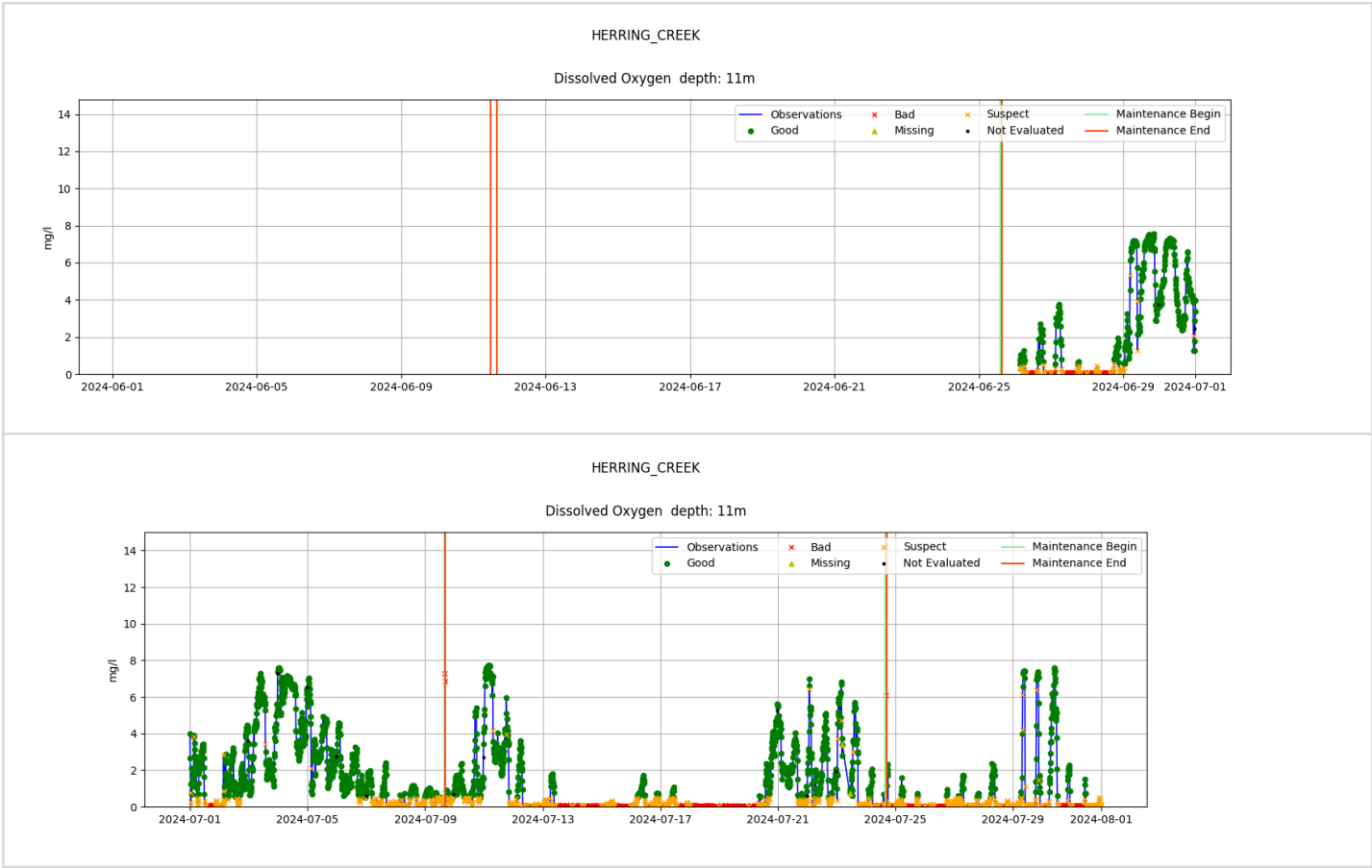
Herring Creek 11m Salinity



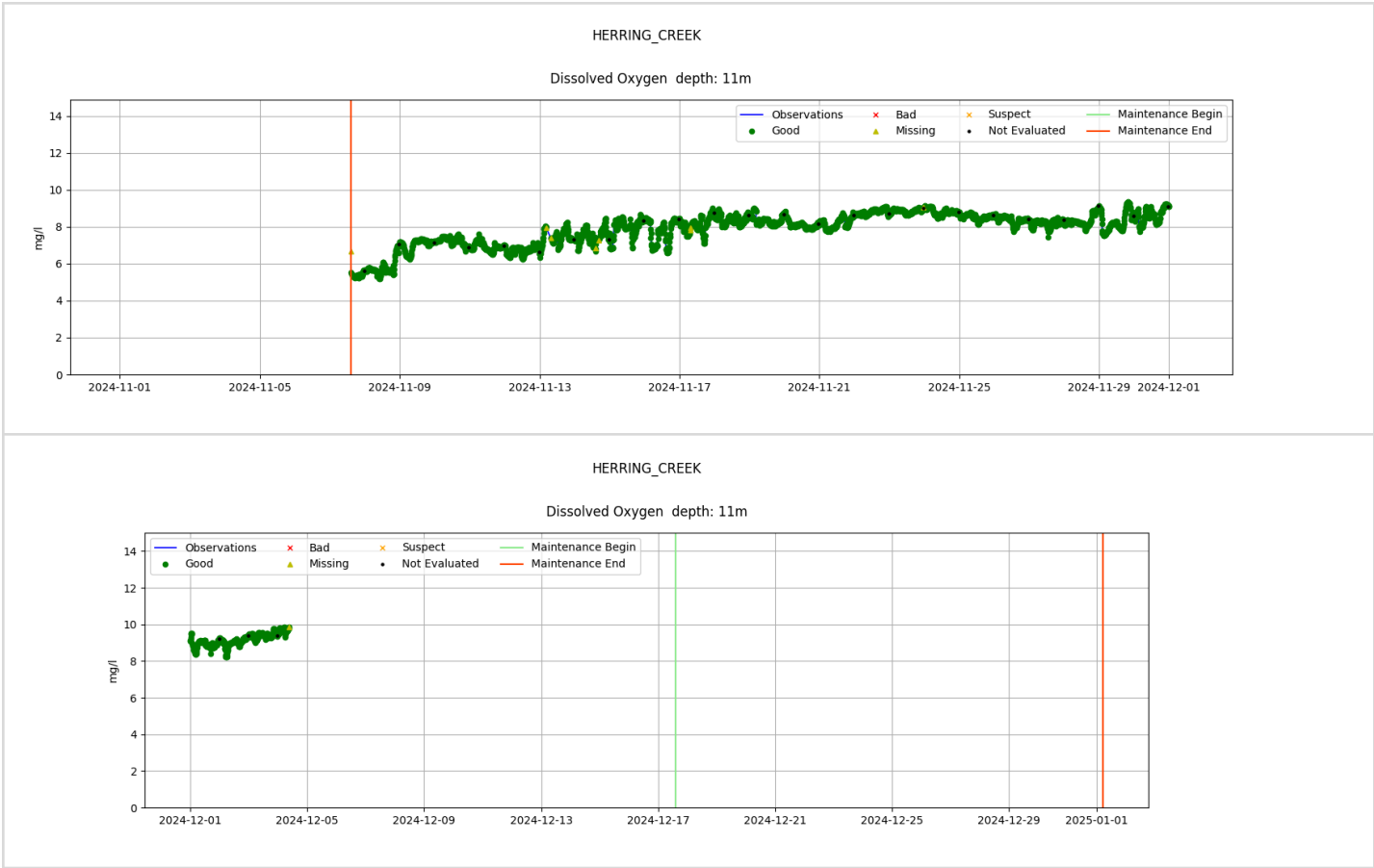




Herring Creek 11m Dissolved Oxygen

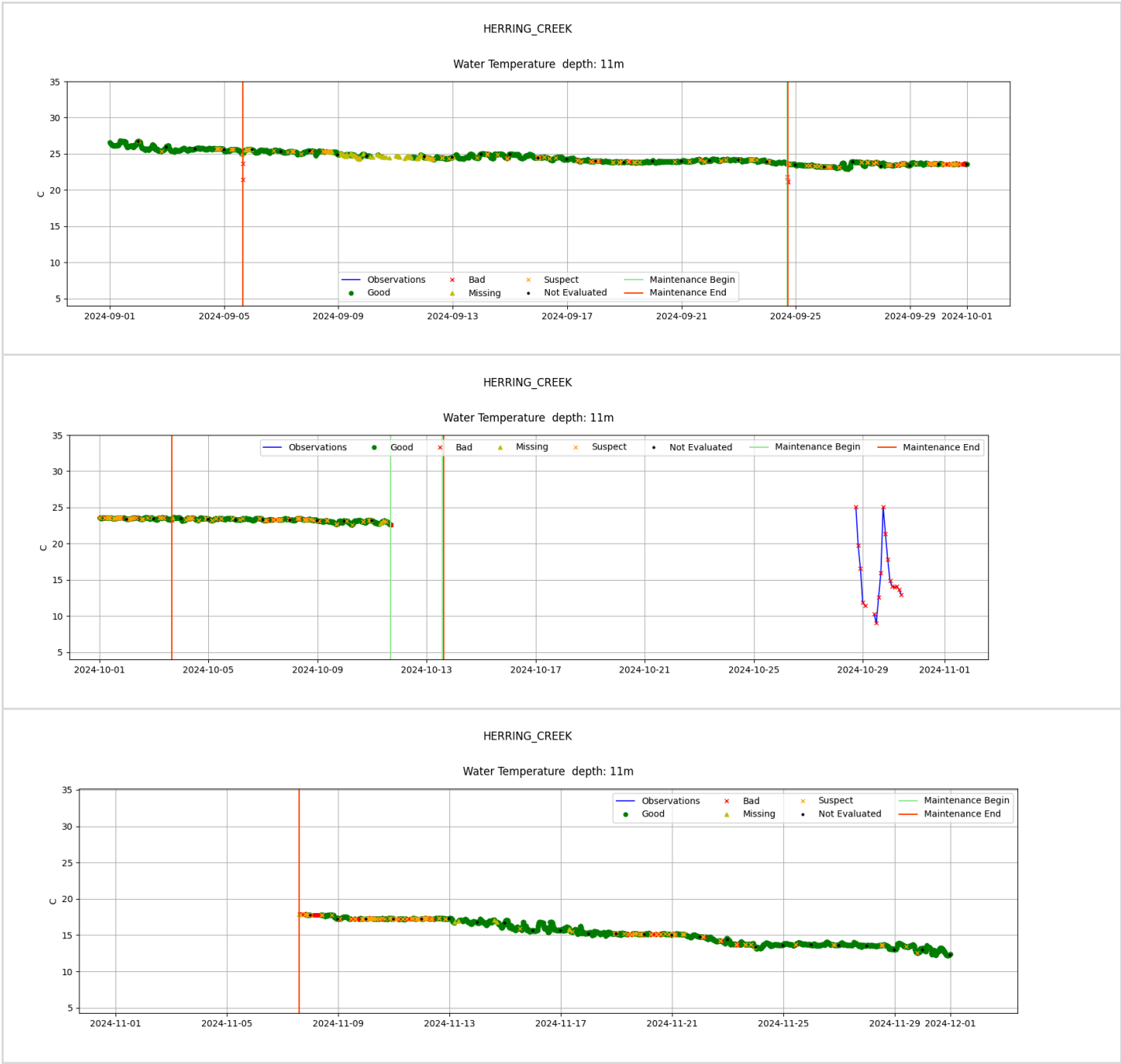




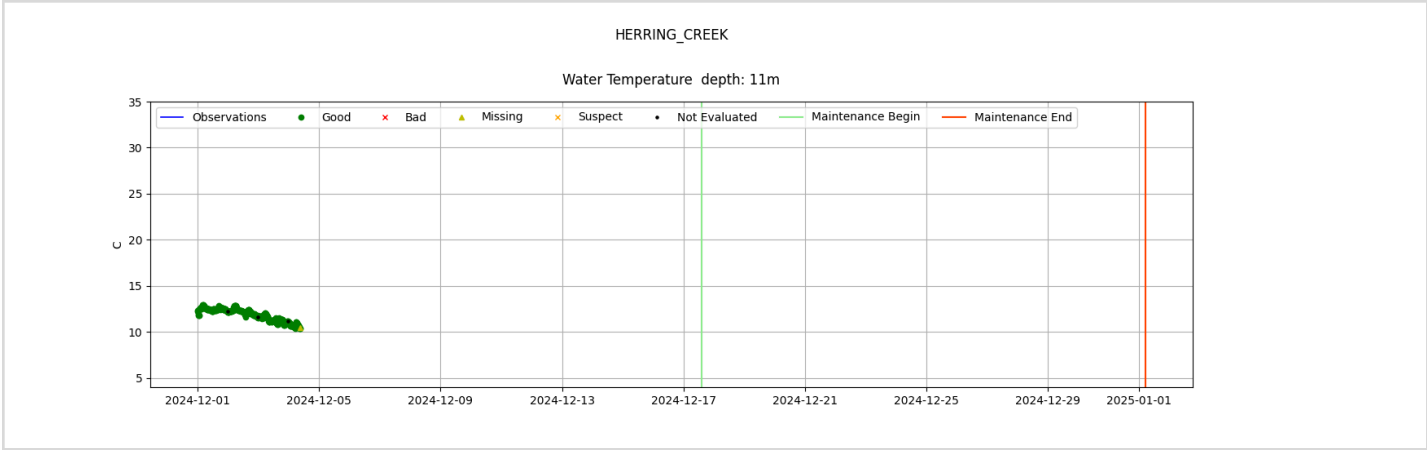


Herring Creek 11m Water Temperature



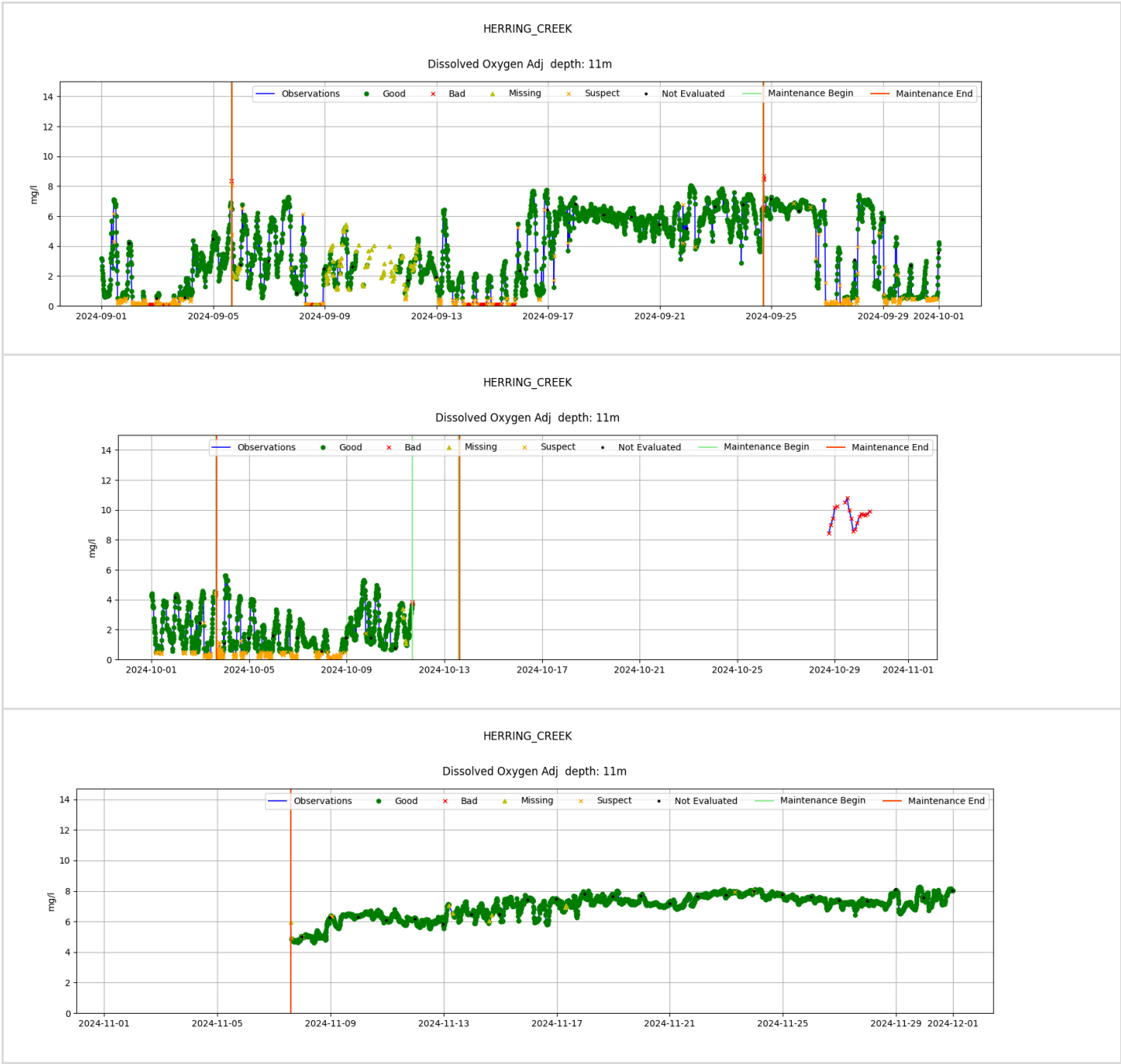


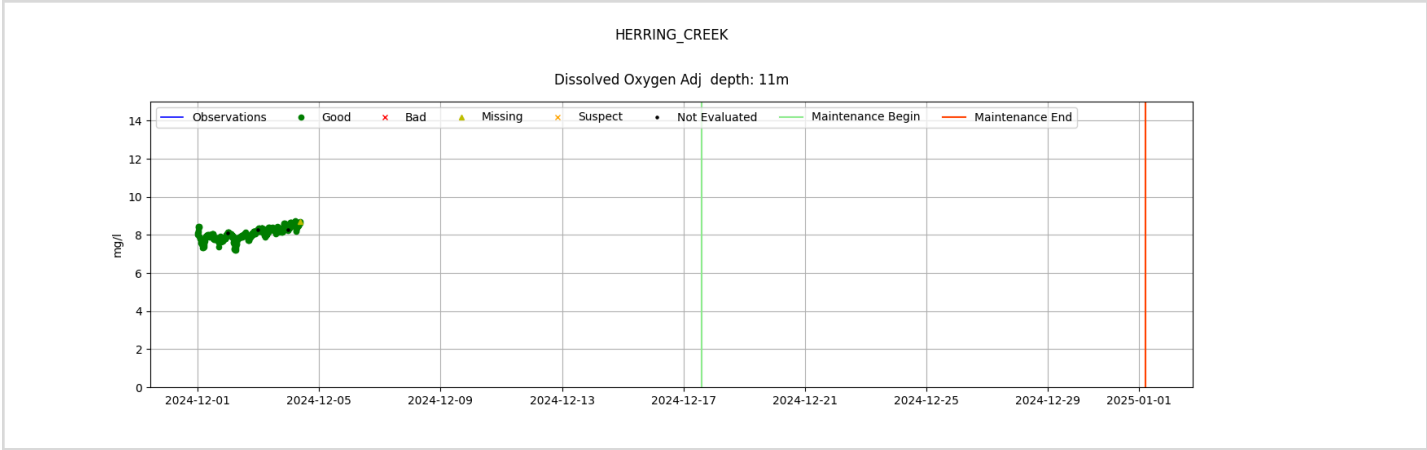




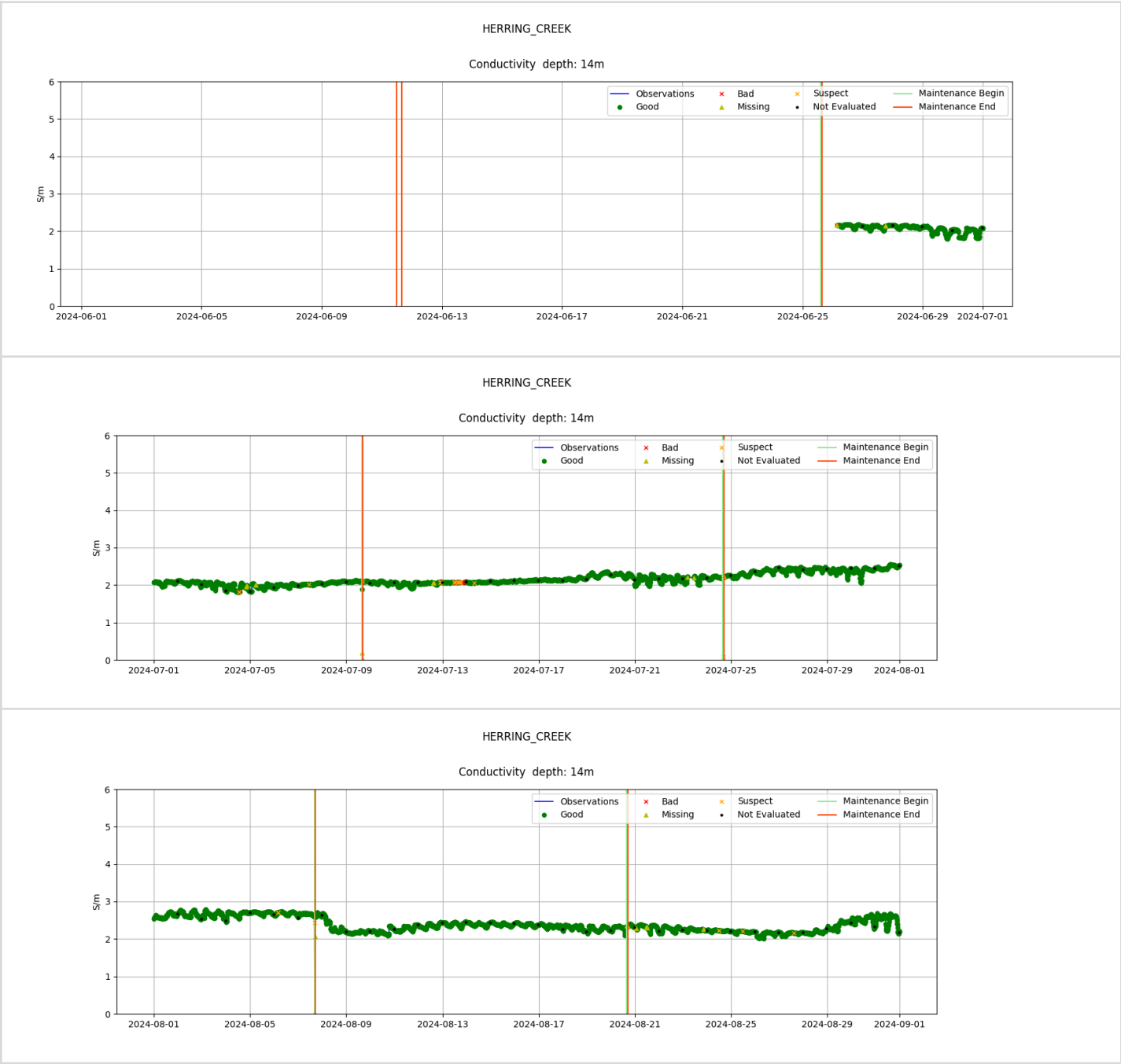
Herring Creek 11m Dissolved Oxygen Adjusted

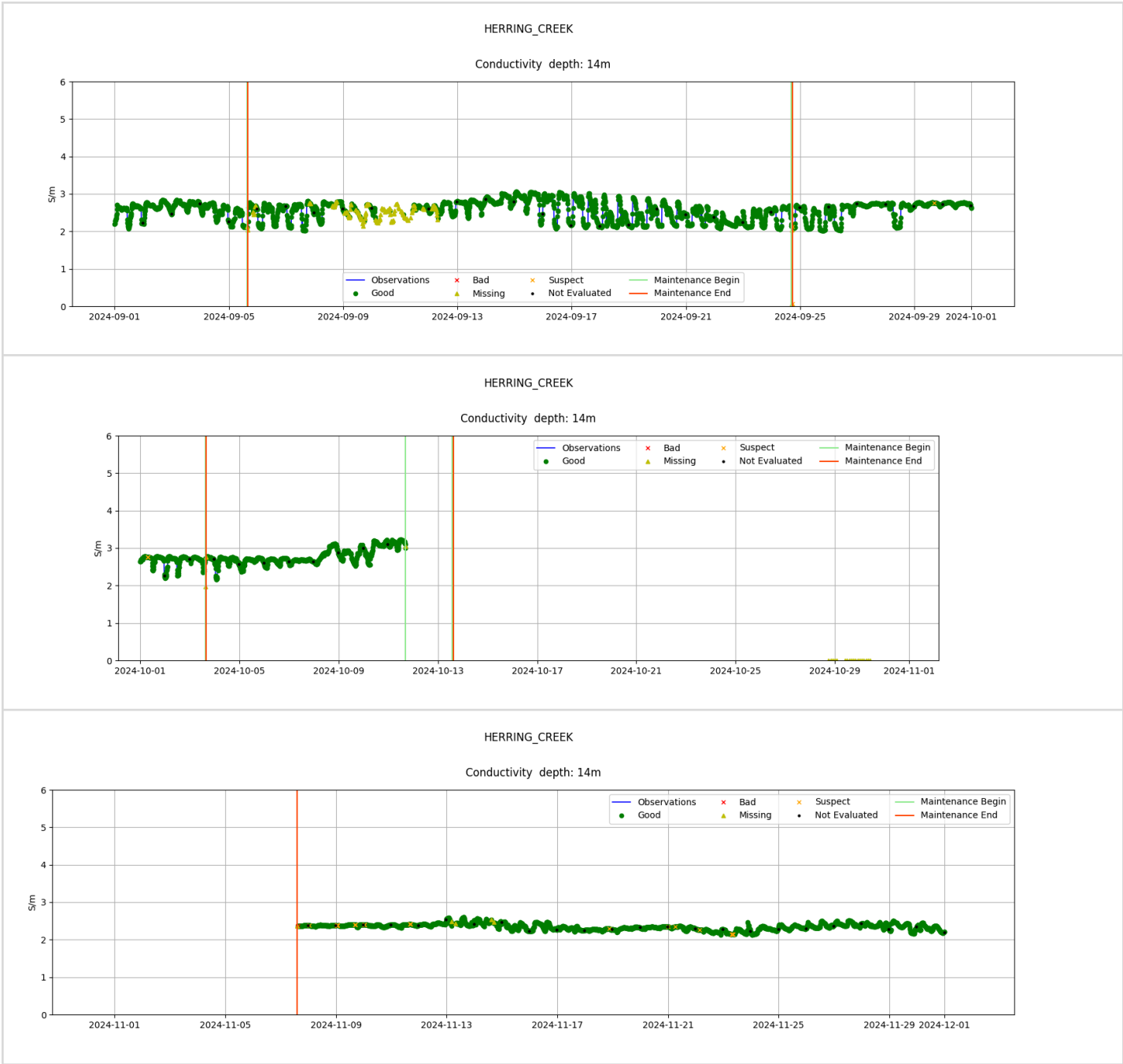


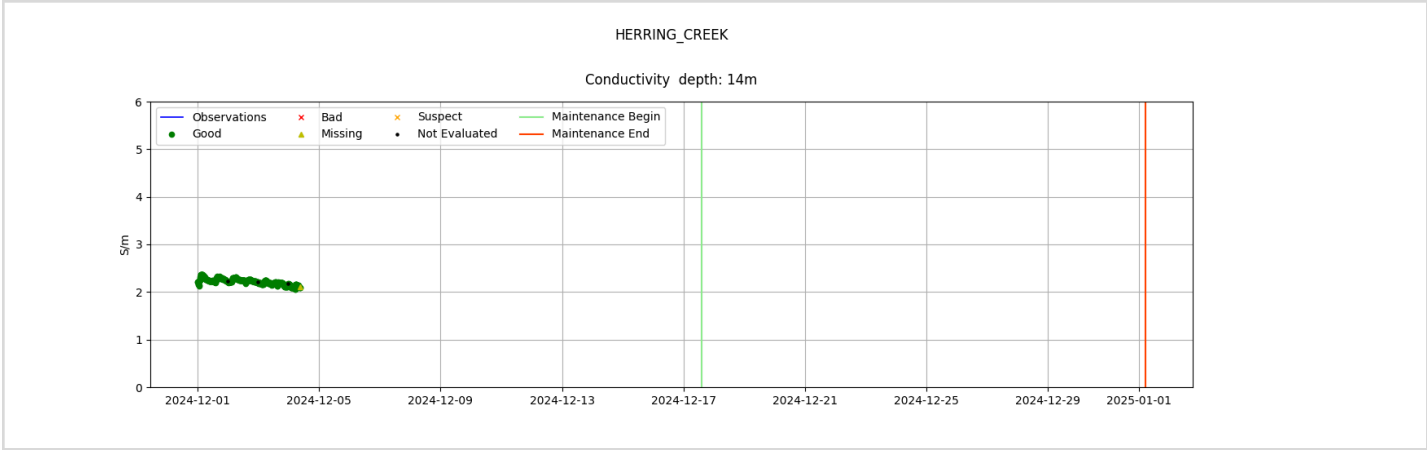




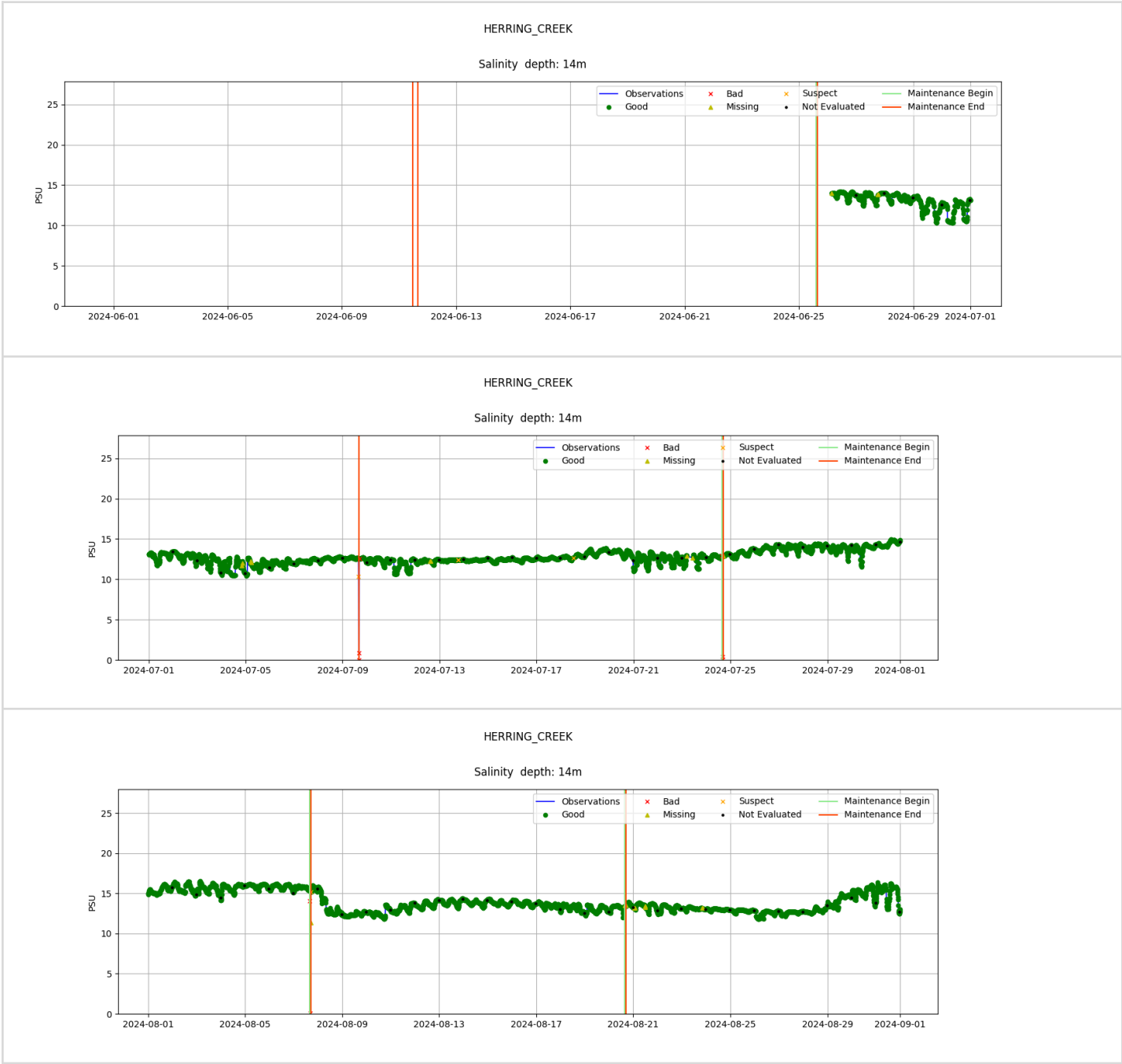
Herring Creek 14m Conductivity





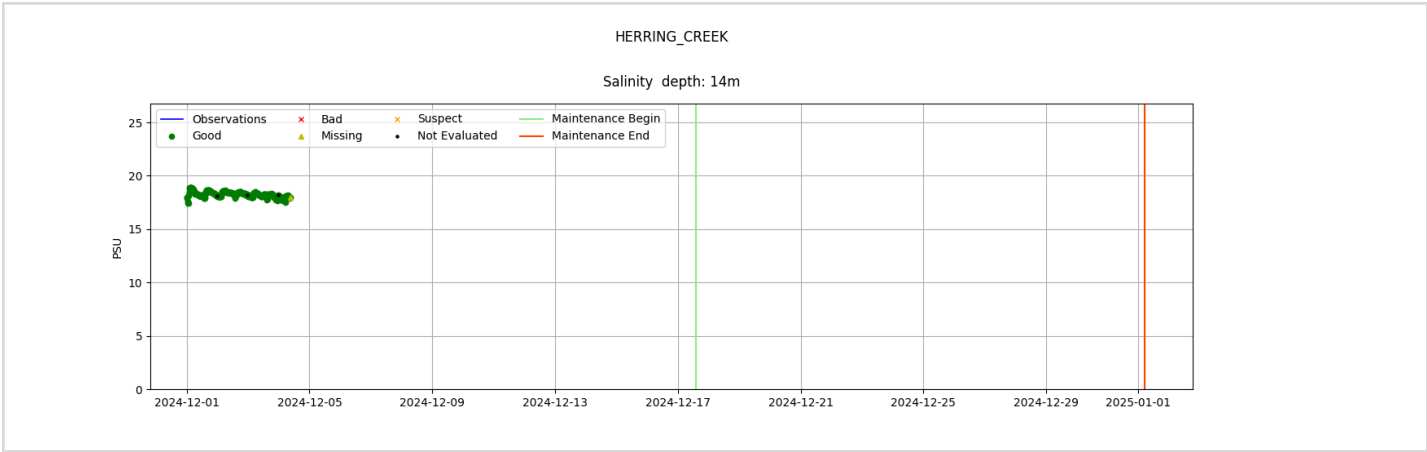


Herring Creek 14m Salinity



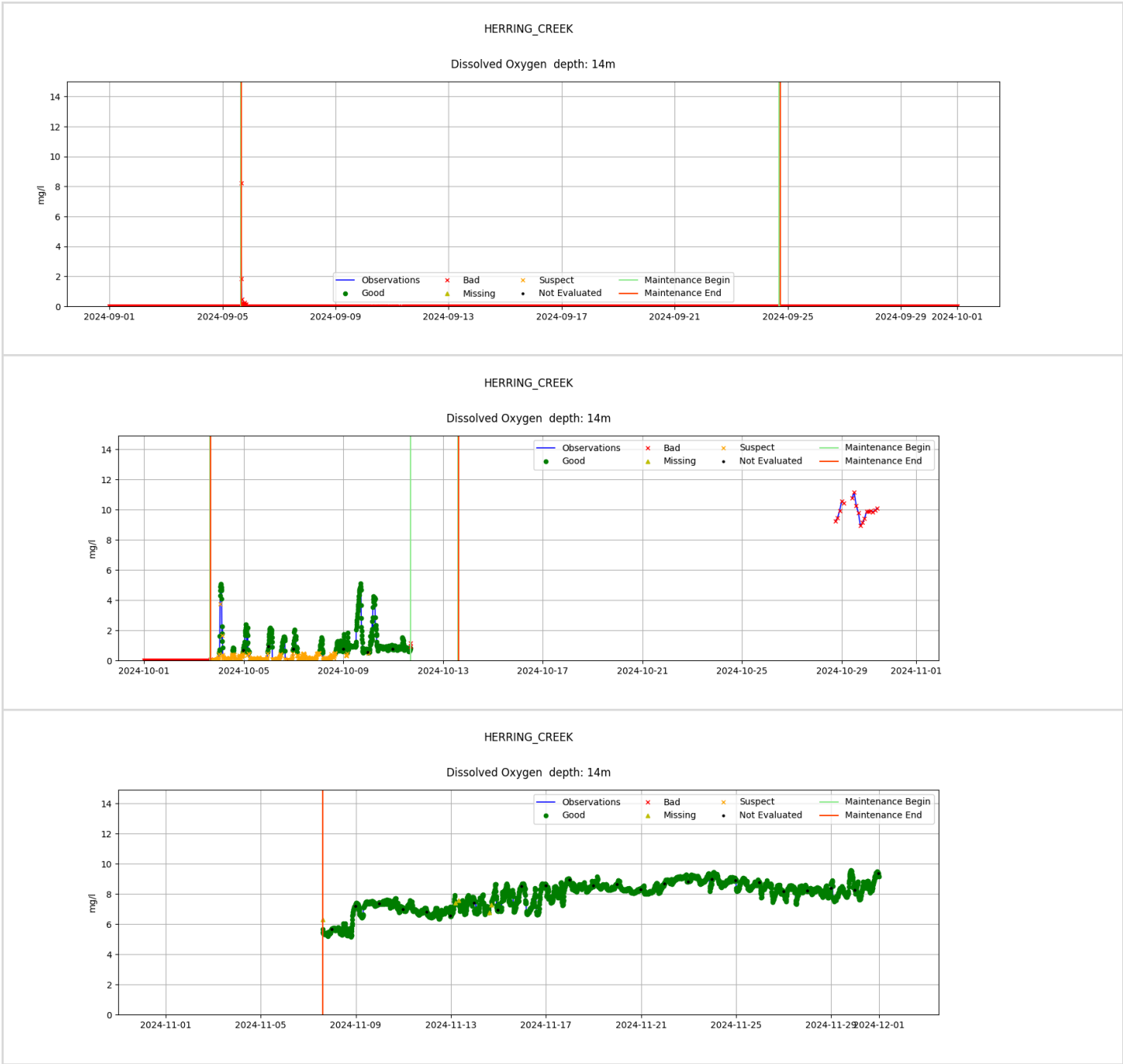


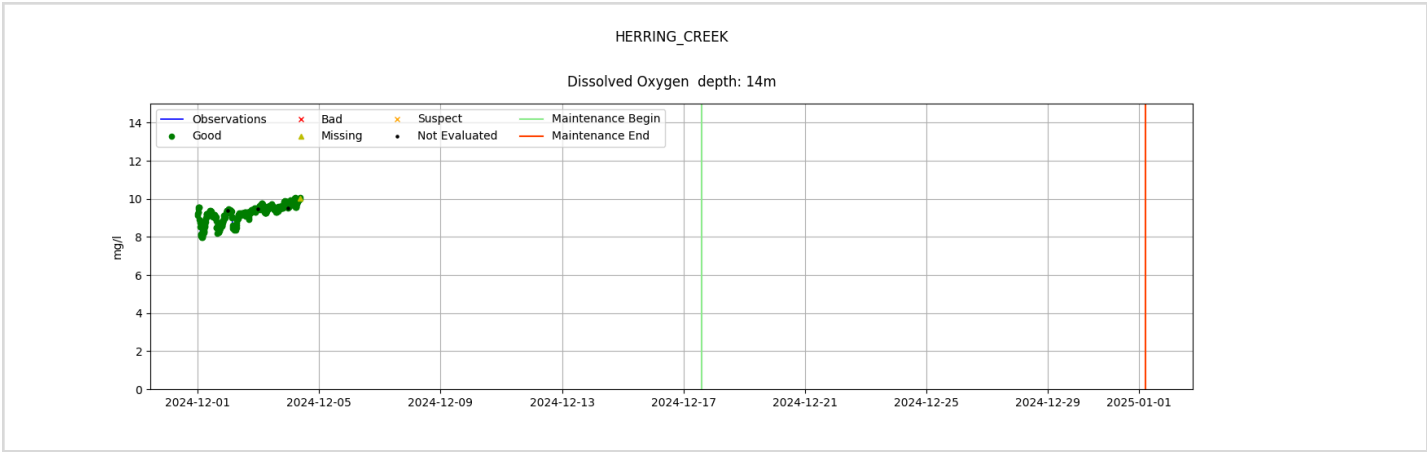




Herring Creek 14m Dissolved Oxygen

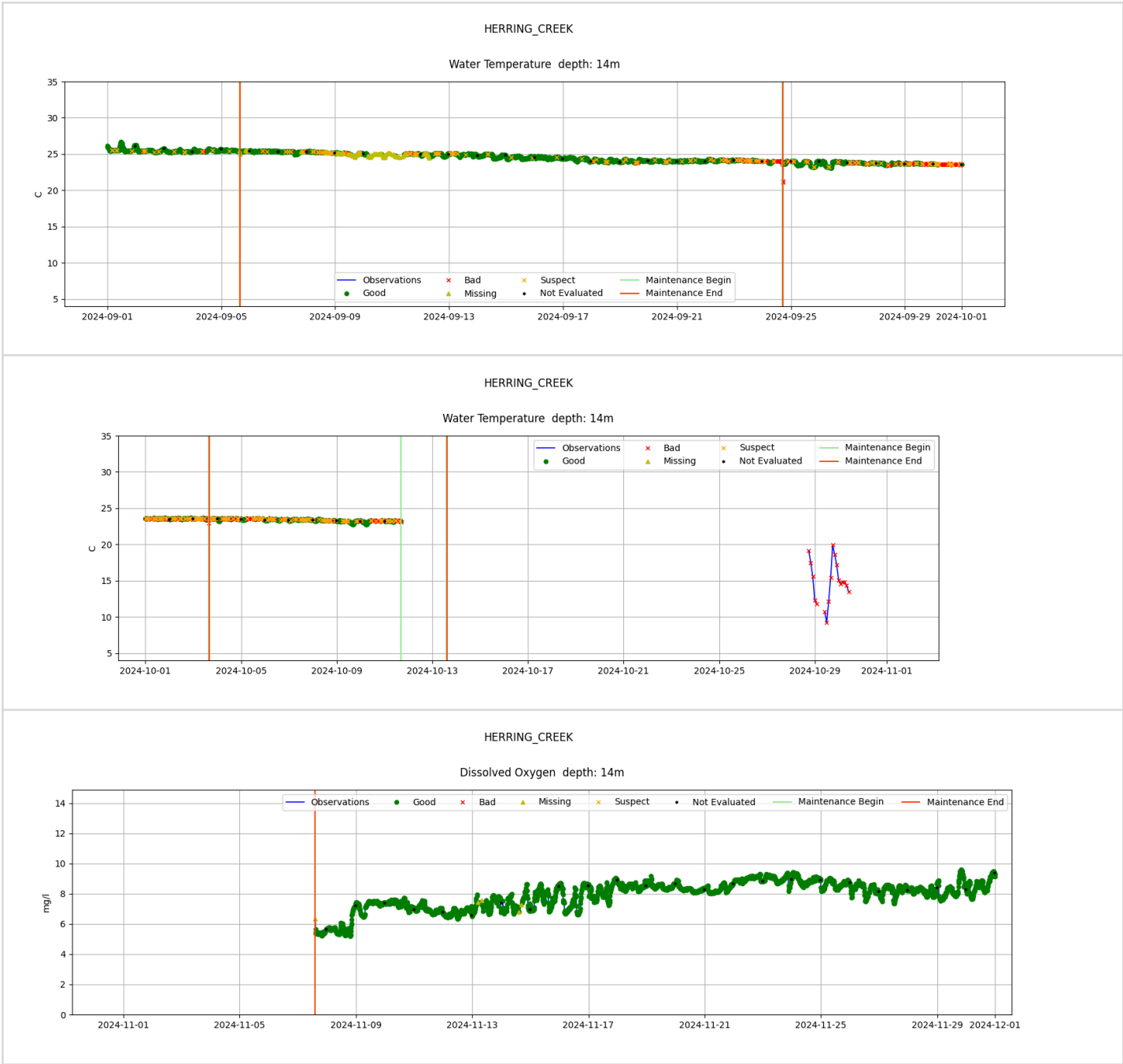


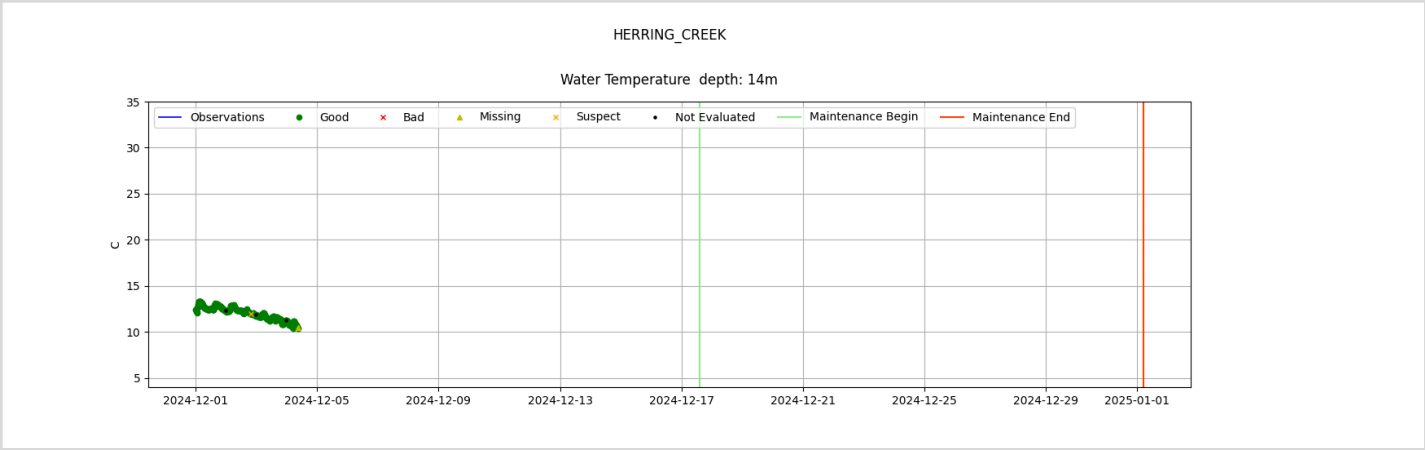




Herring Creek 14m Water Temperature





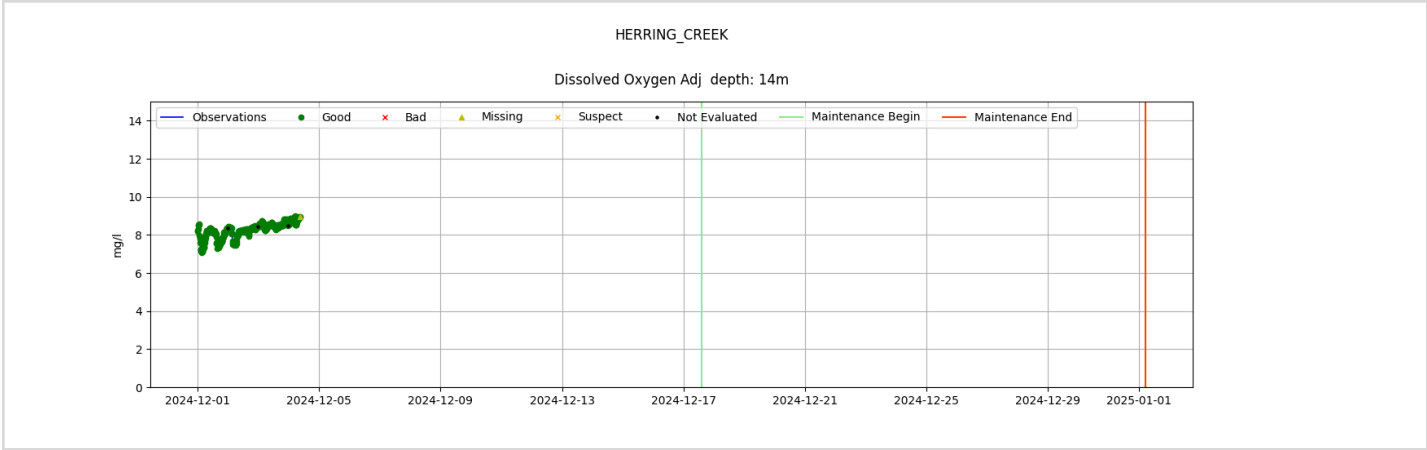




Herring Creek 14m Dissolved Oxygen Adjusted

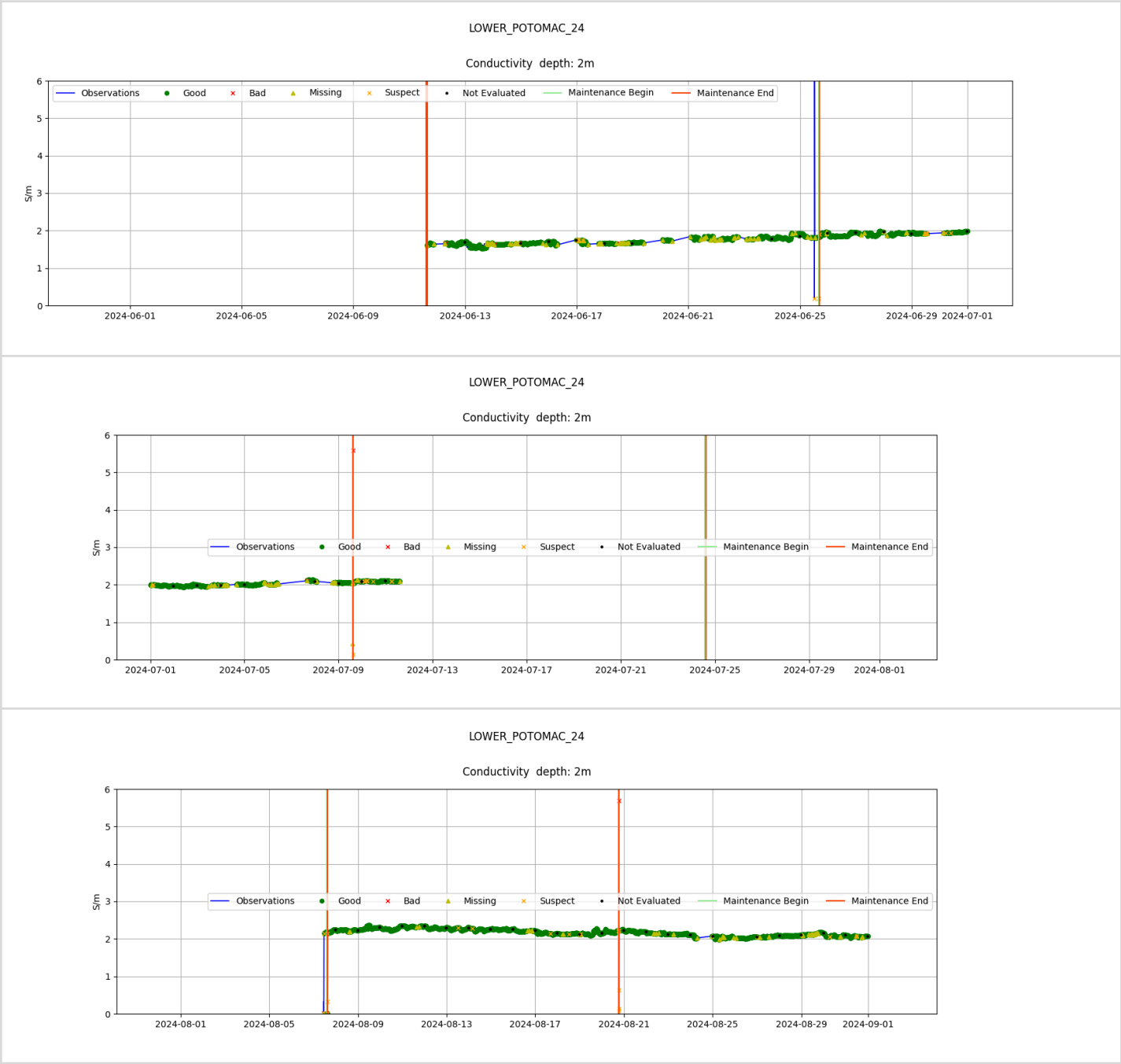


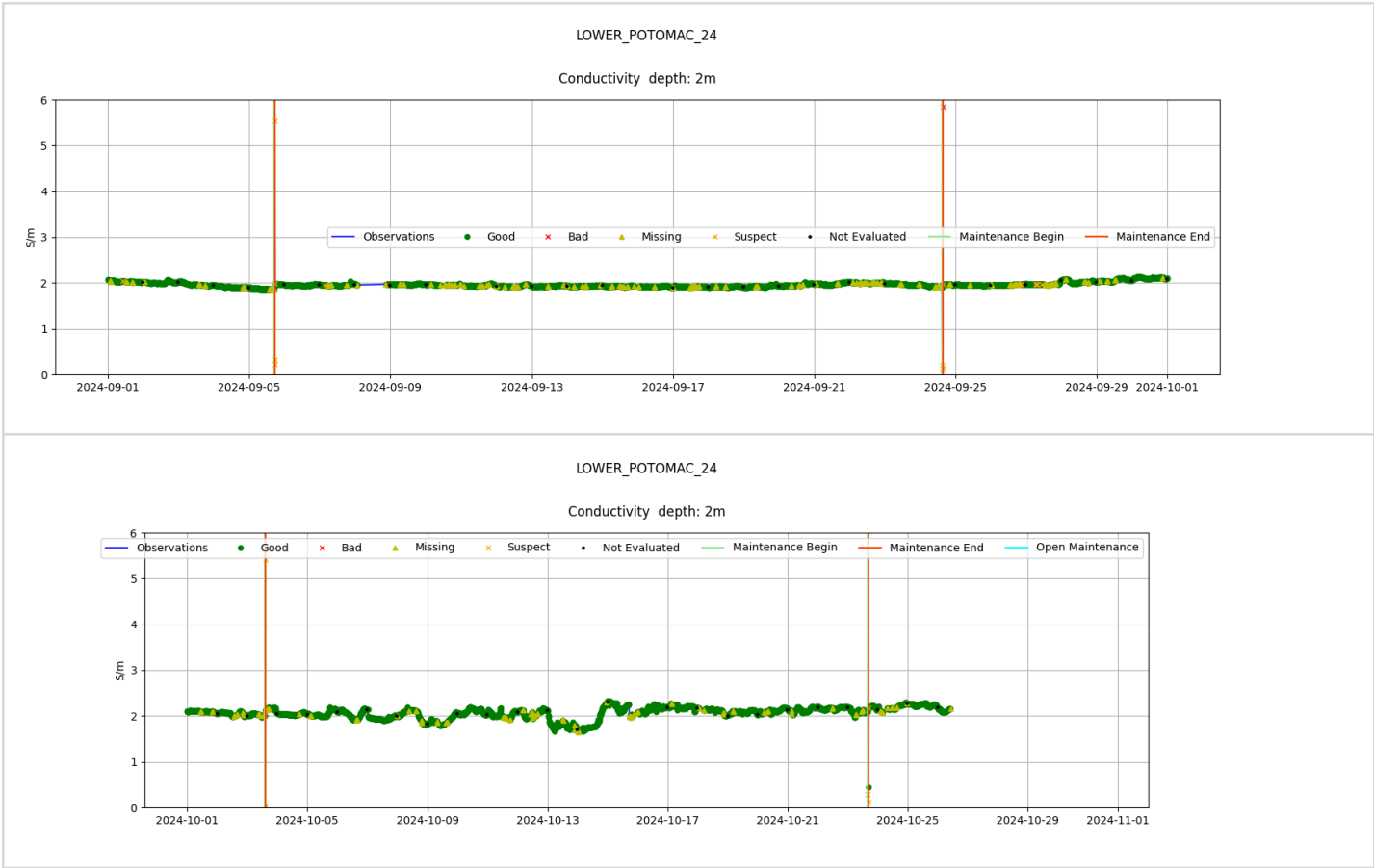




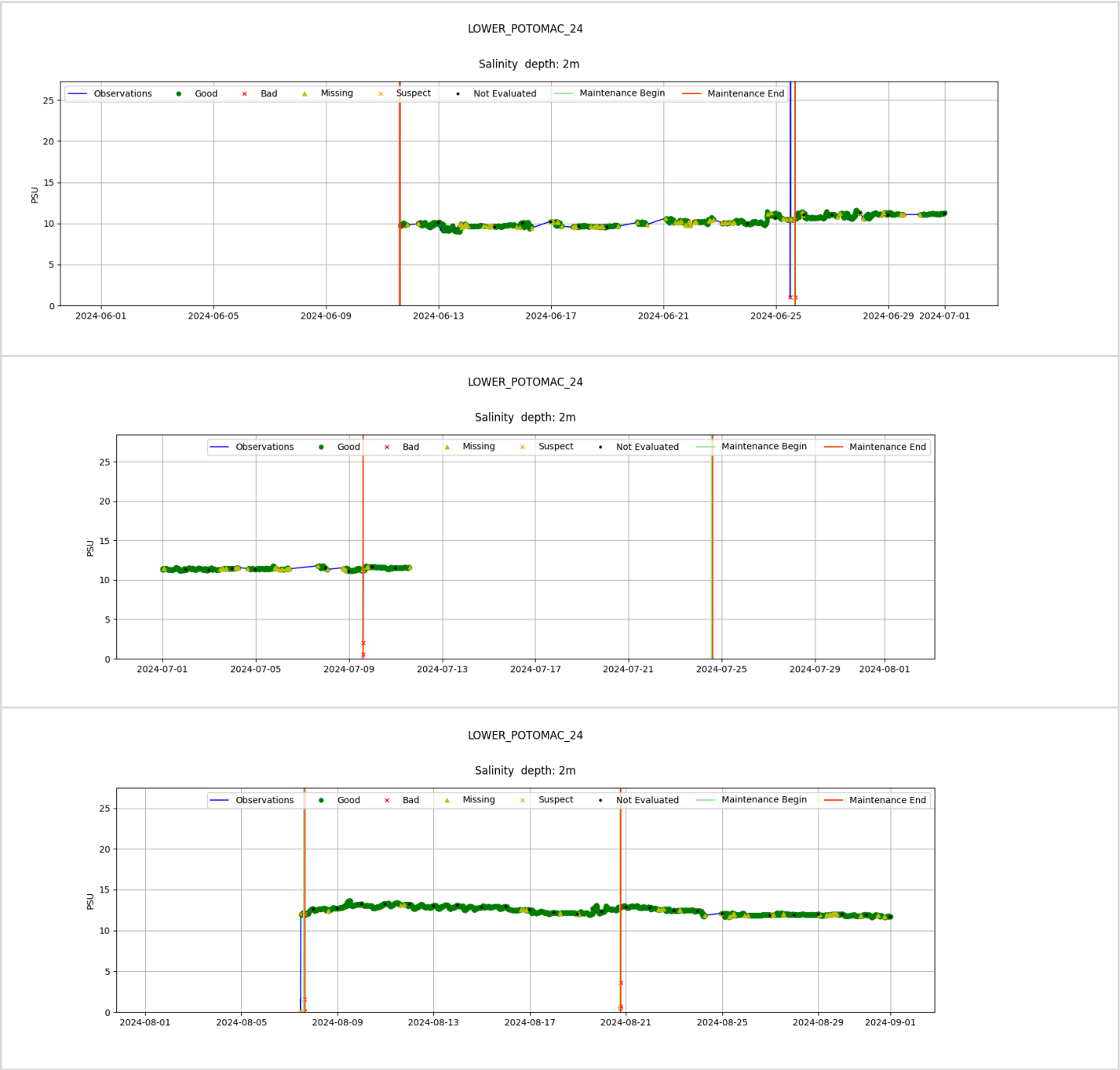
## 8.5 Lower Potomac

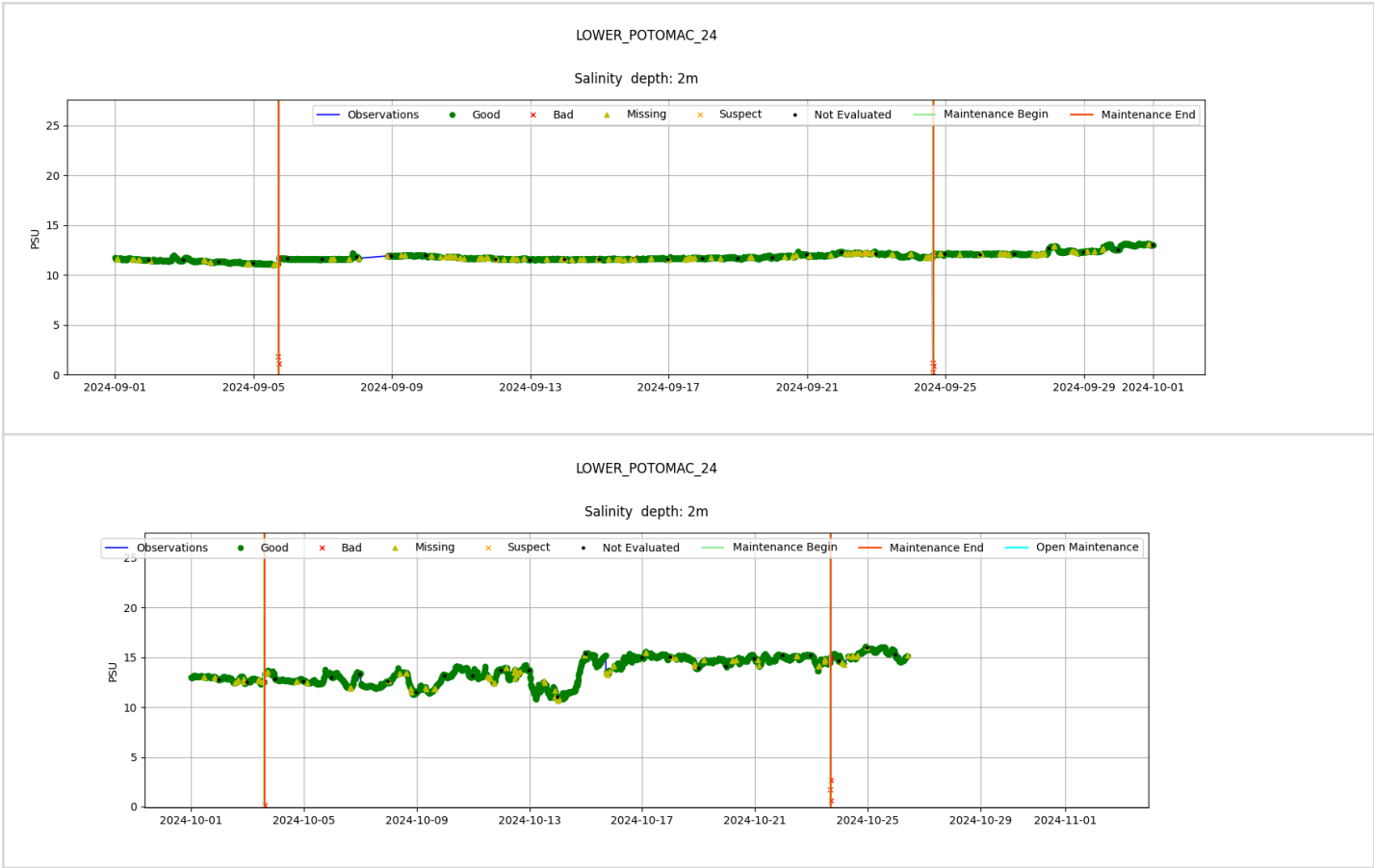
### Lower Potomac 2m Conductivity





Lower Potomac 2m Salinity





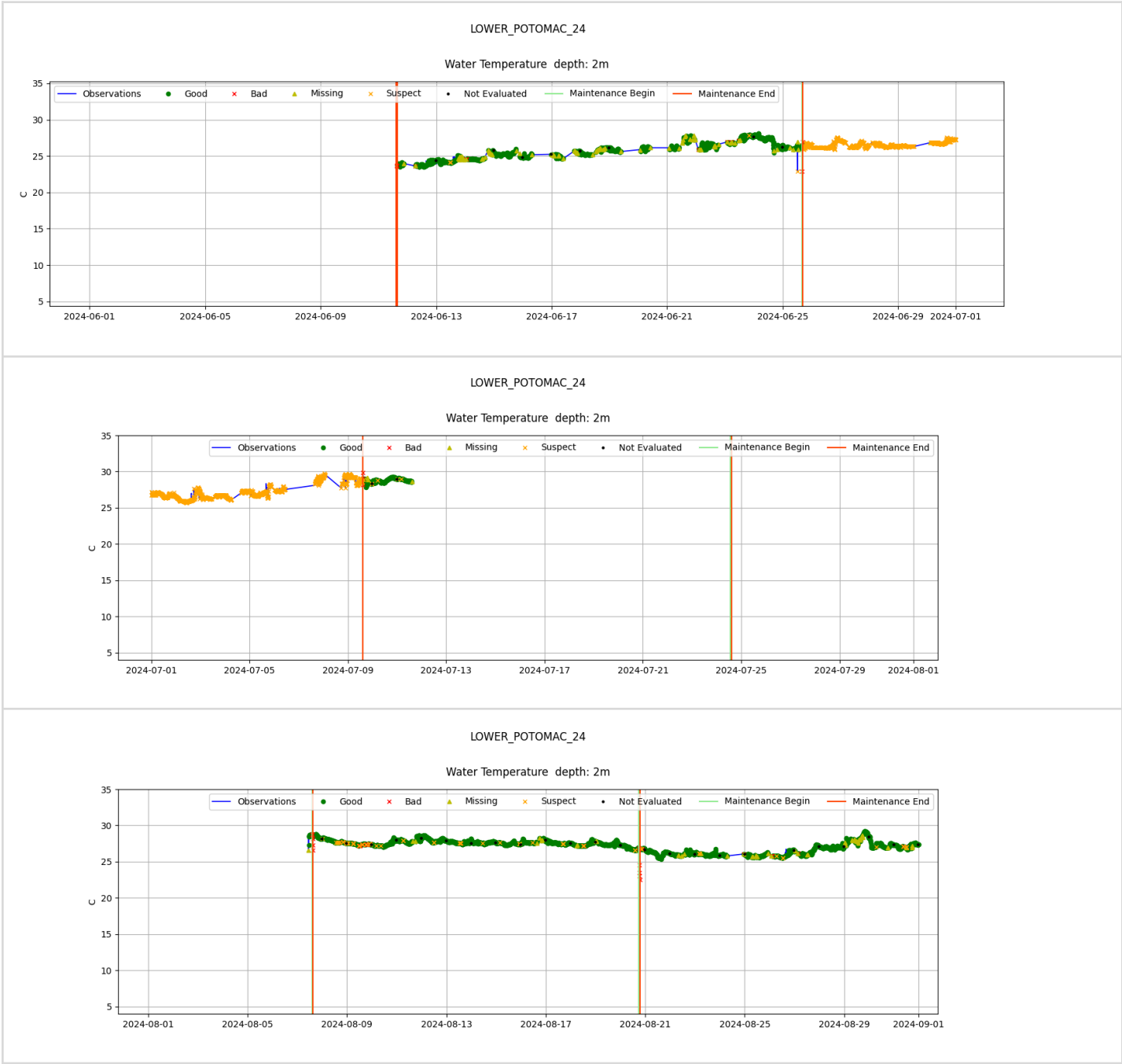
Lower Potomac 2m Dissolved Oxygen





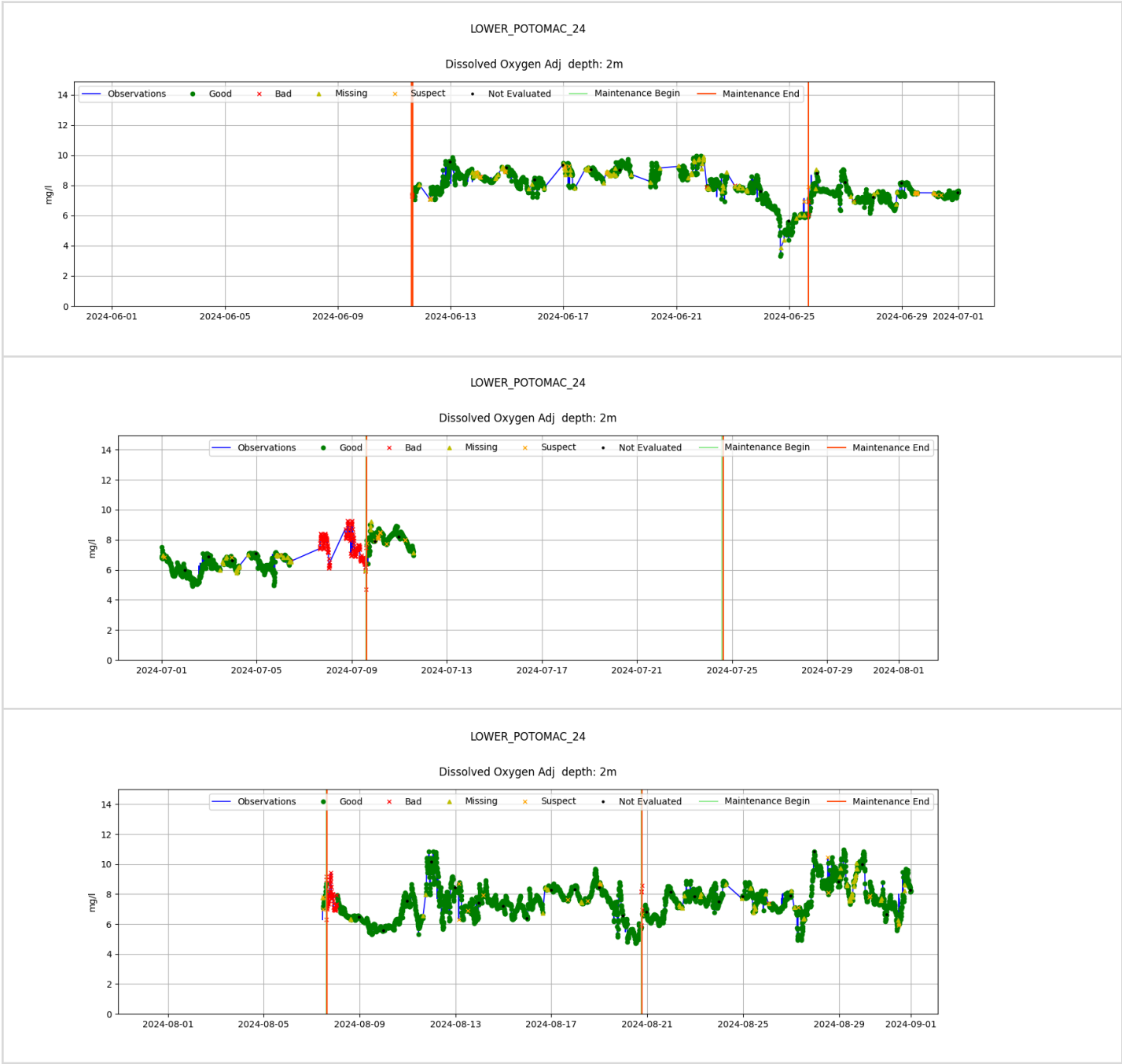


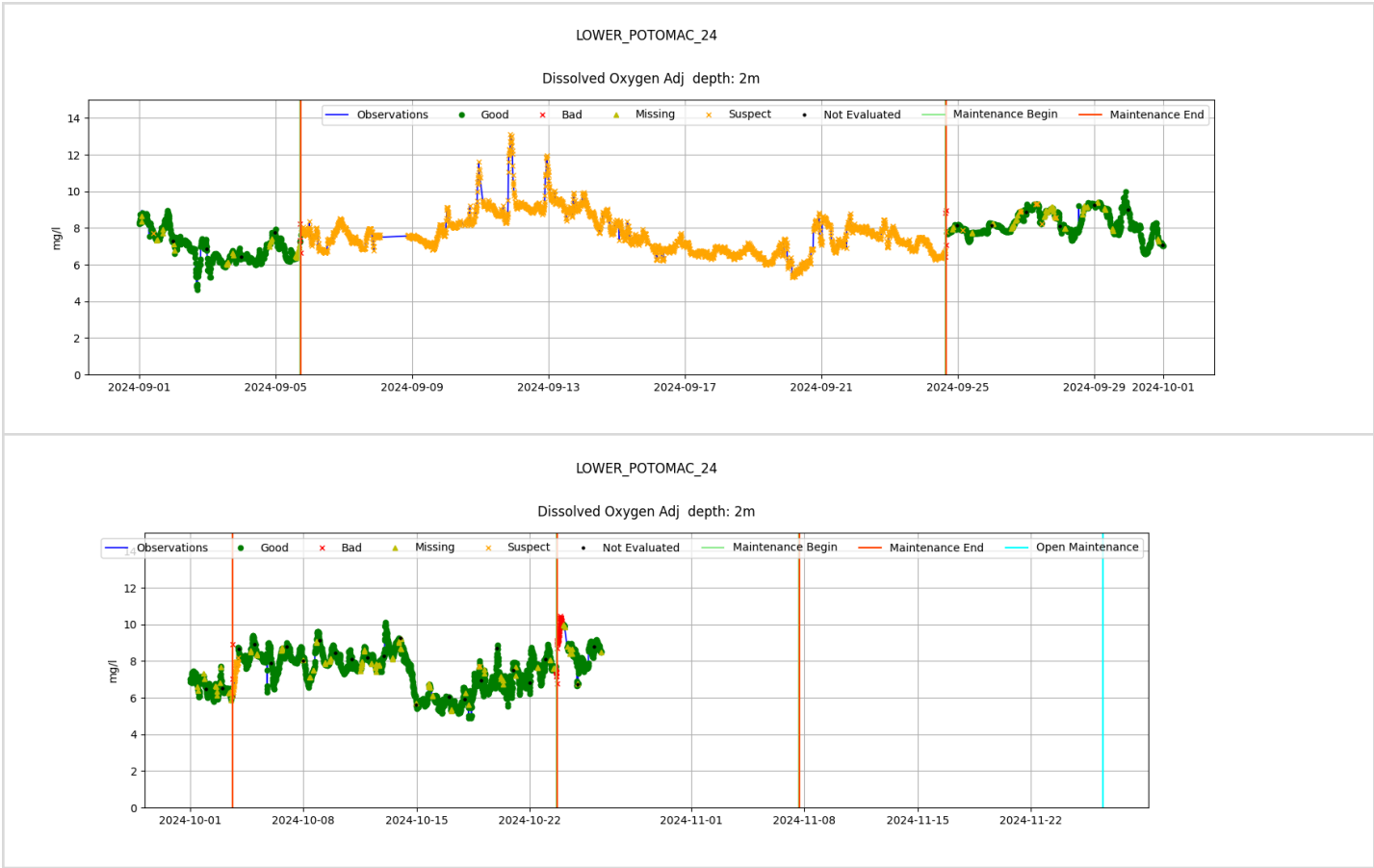
Lower Potomac 2m Water Temperature



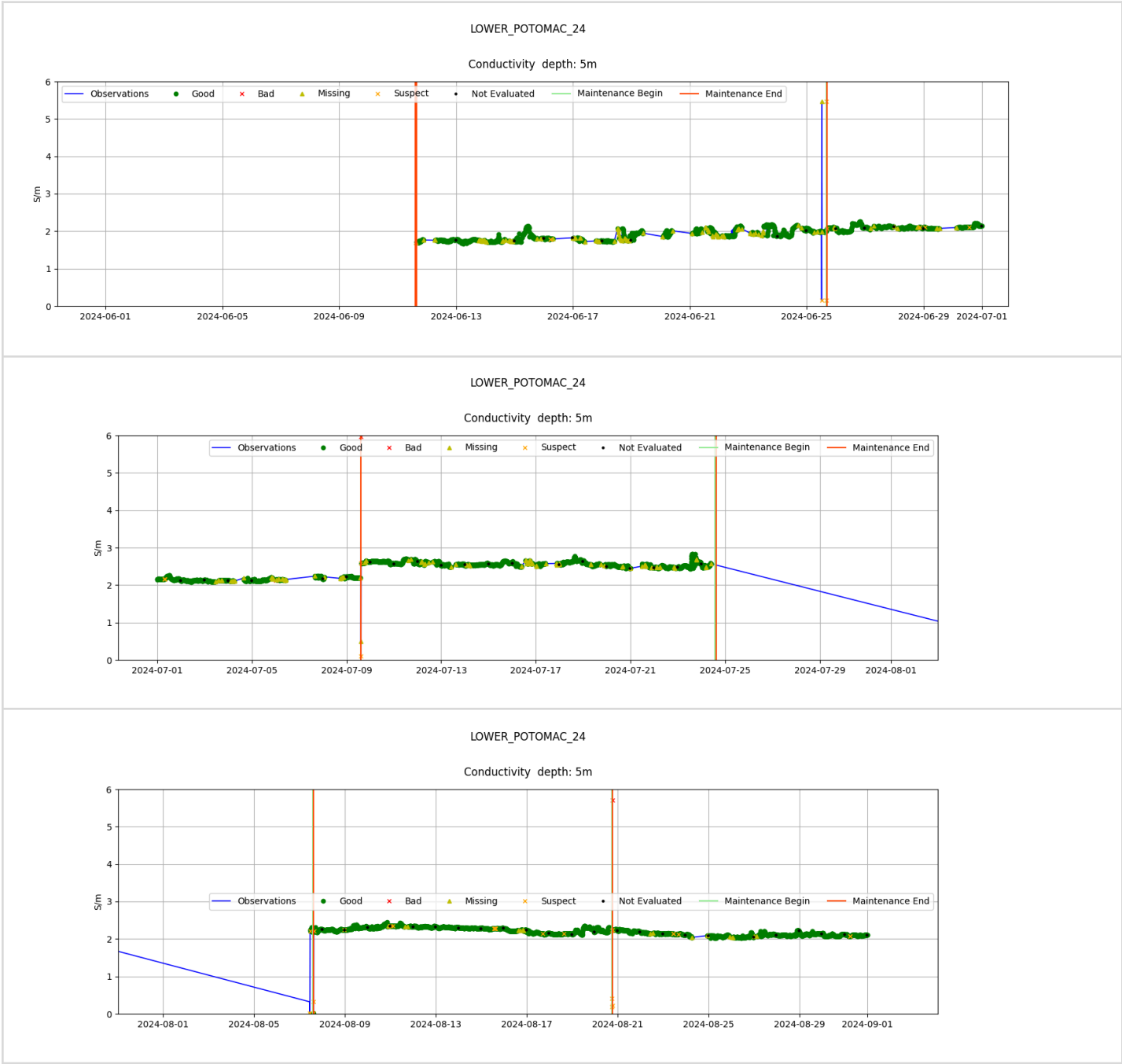


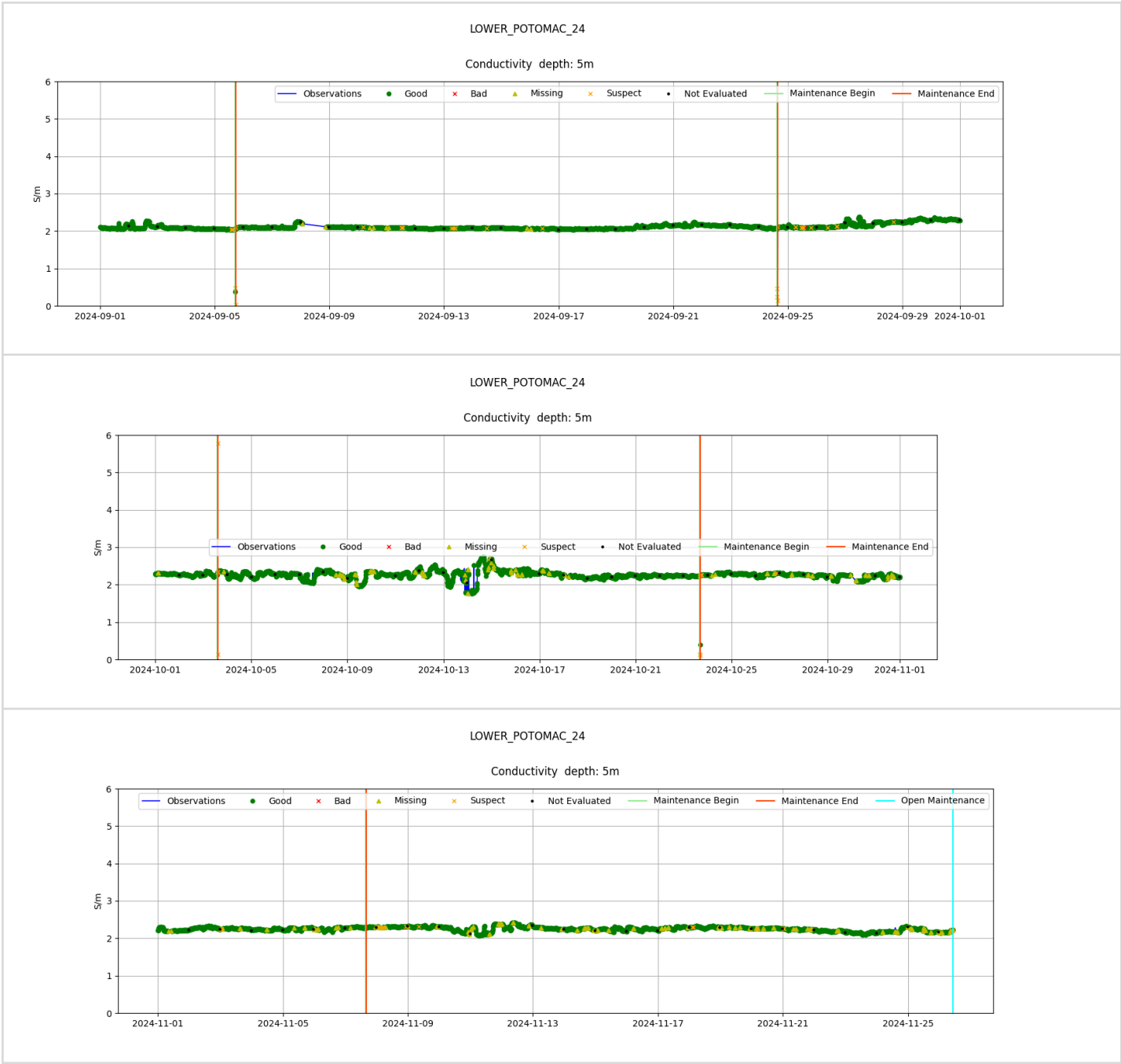
Lower Potomac 2m Dissolved Oxygen Adjusted



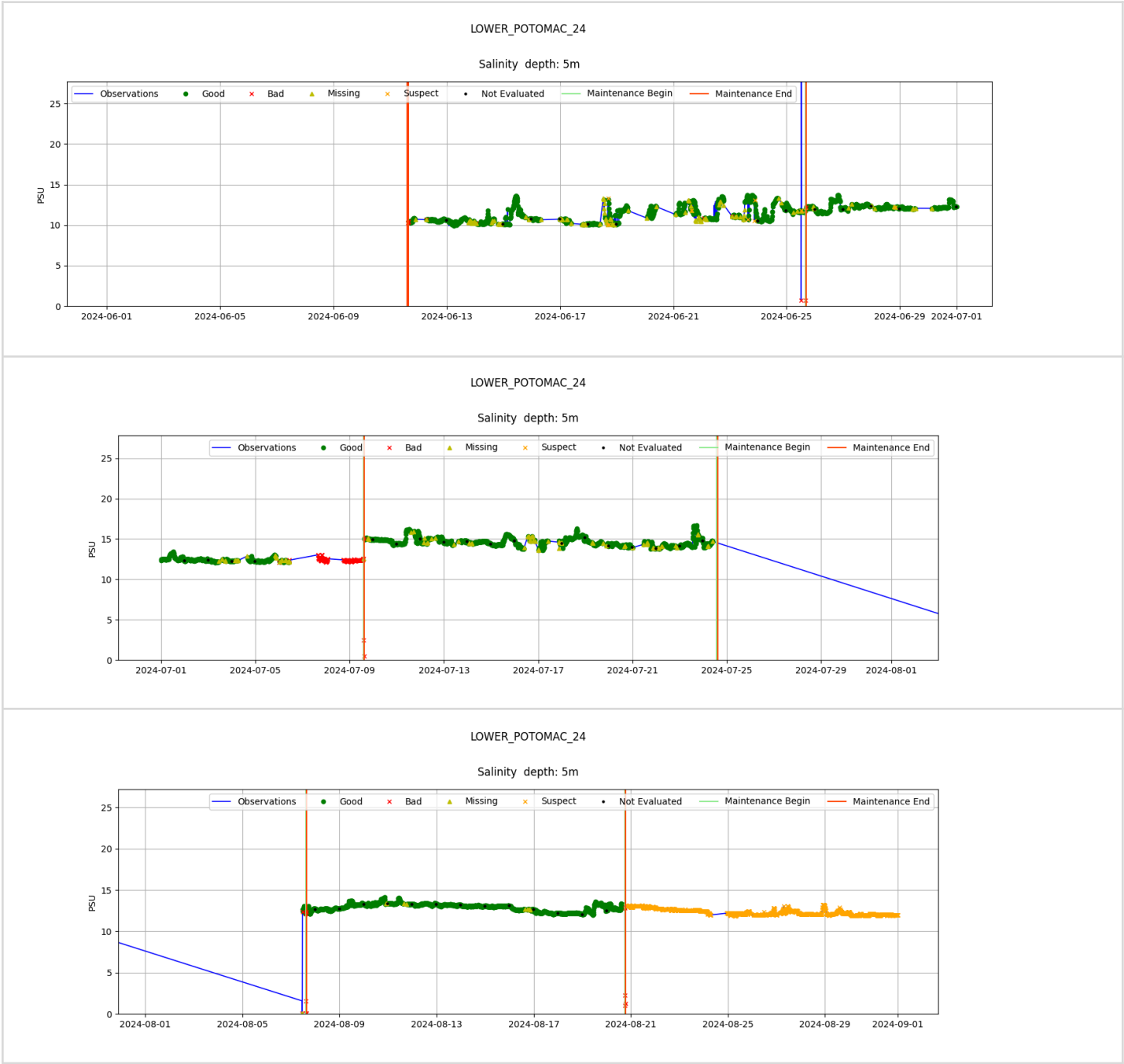


Lower Potomac 5m Conductivity

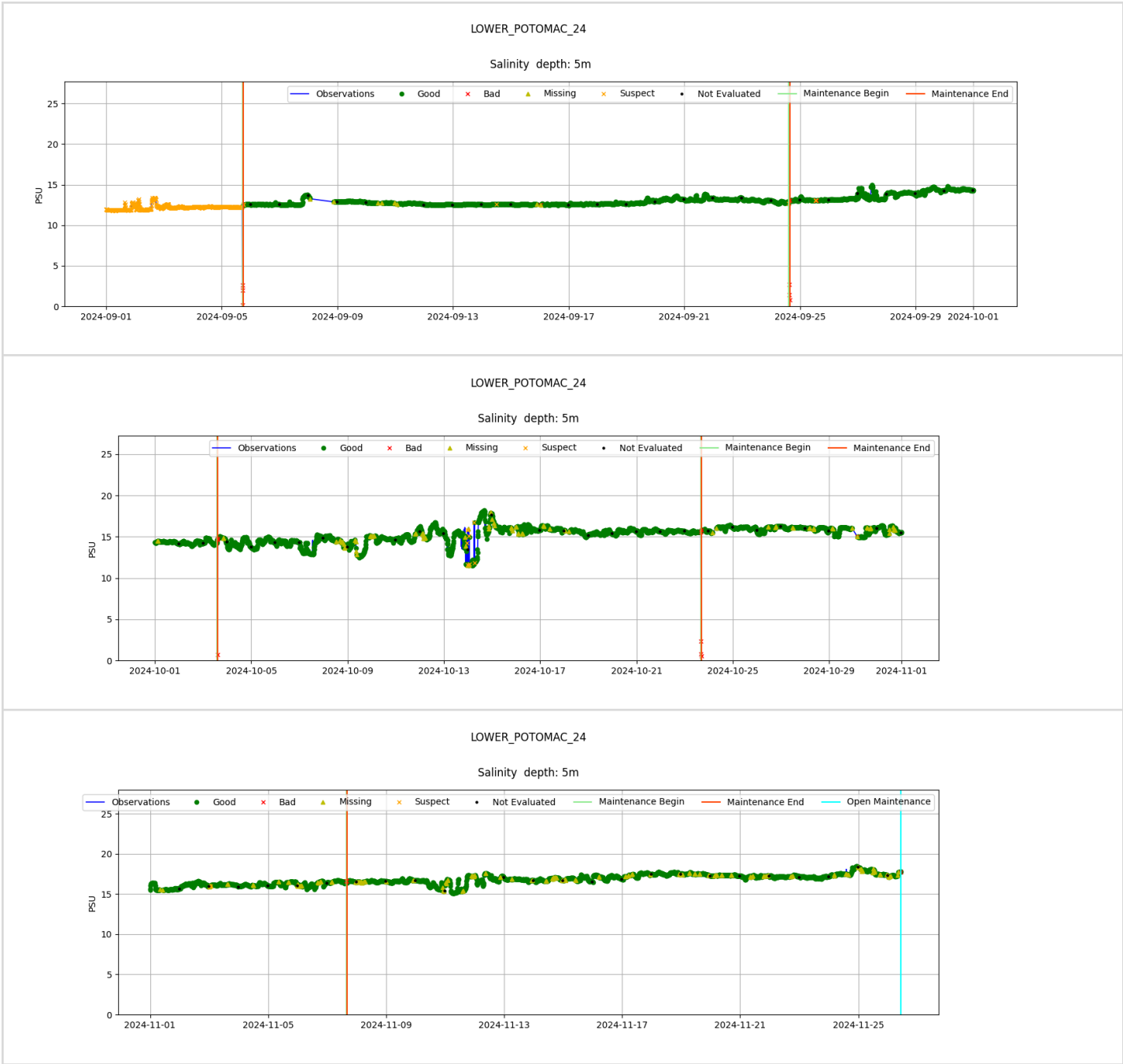




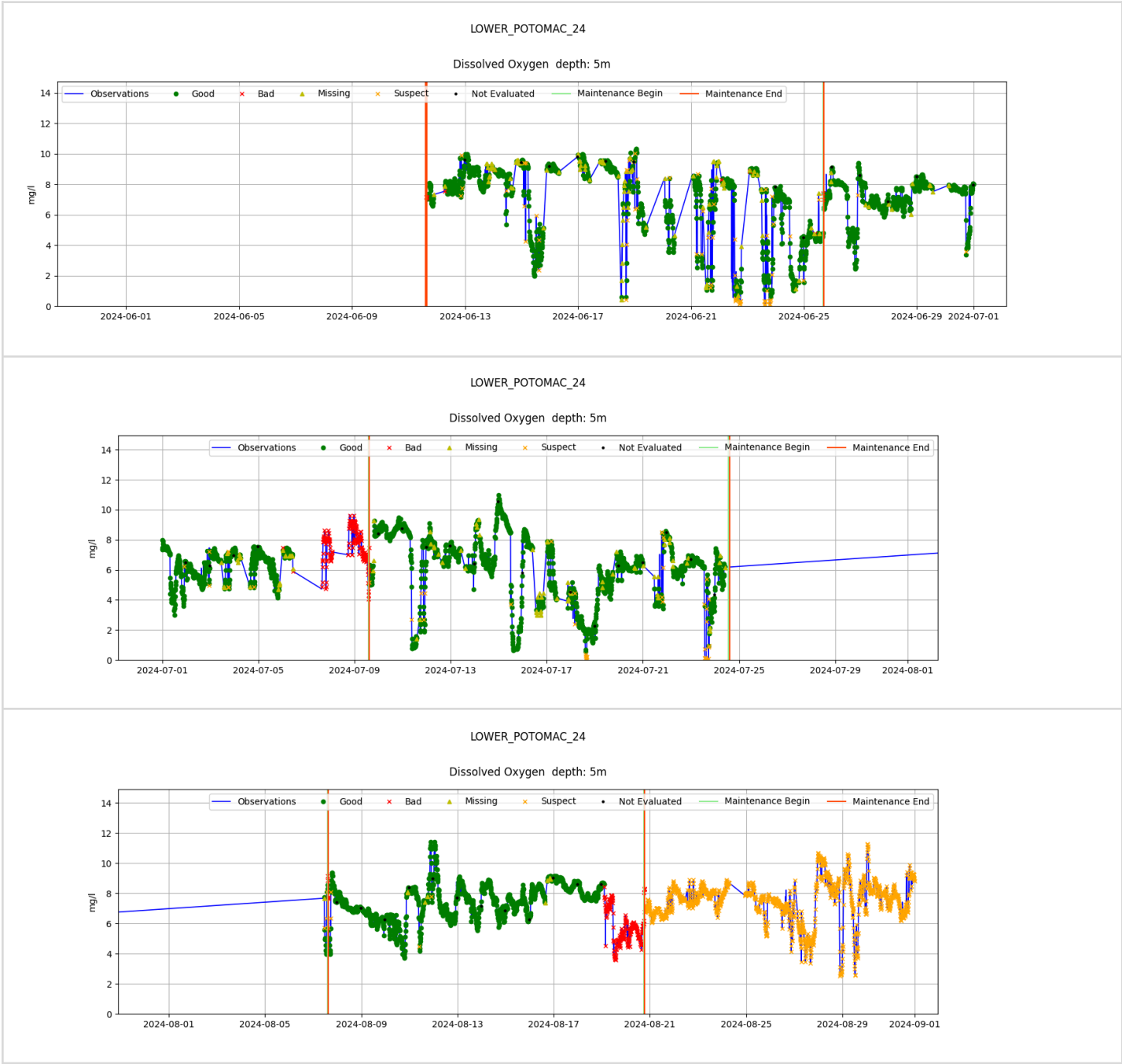
Lower Potomac 5m Salinity

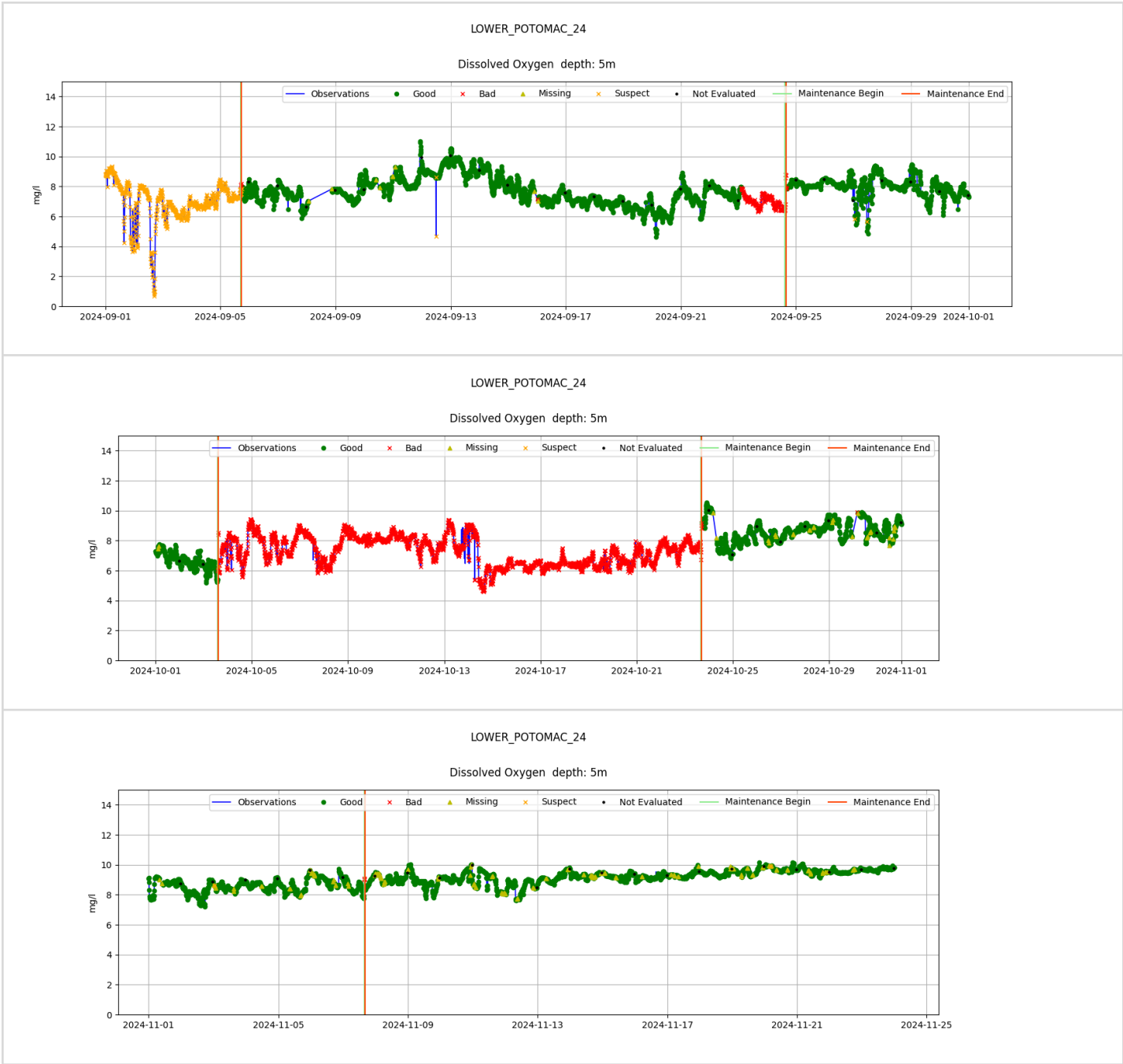






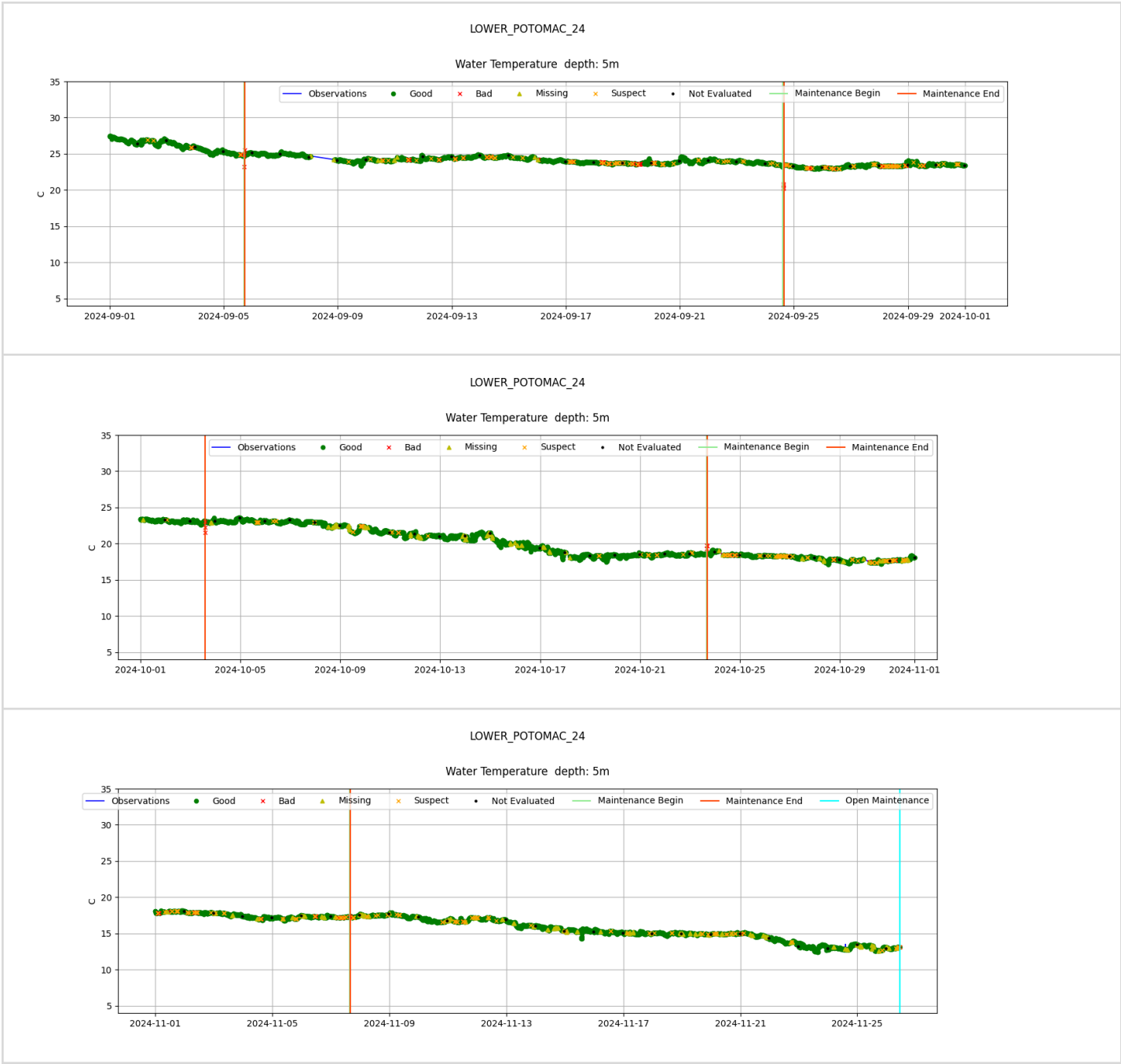
Lower Potomac 5m Dissolved Oxygen



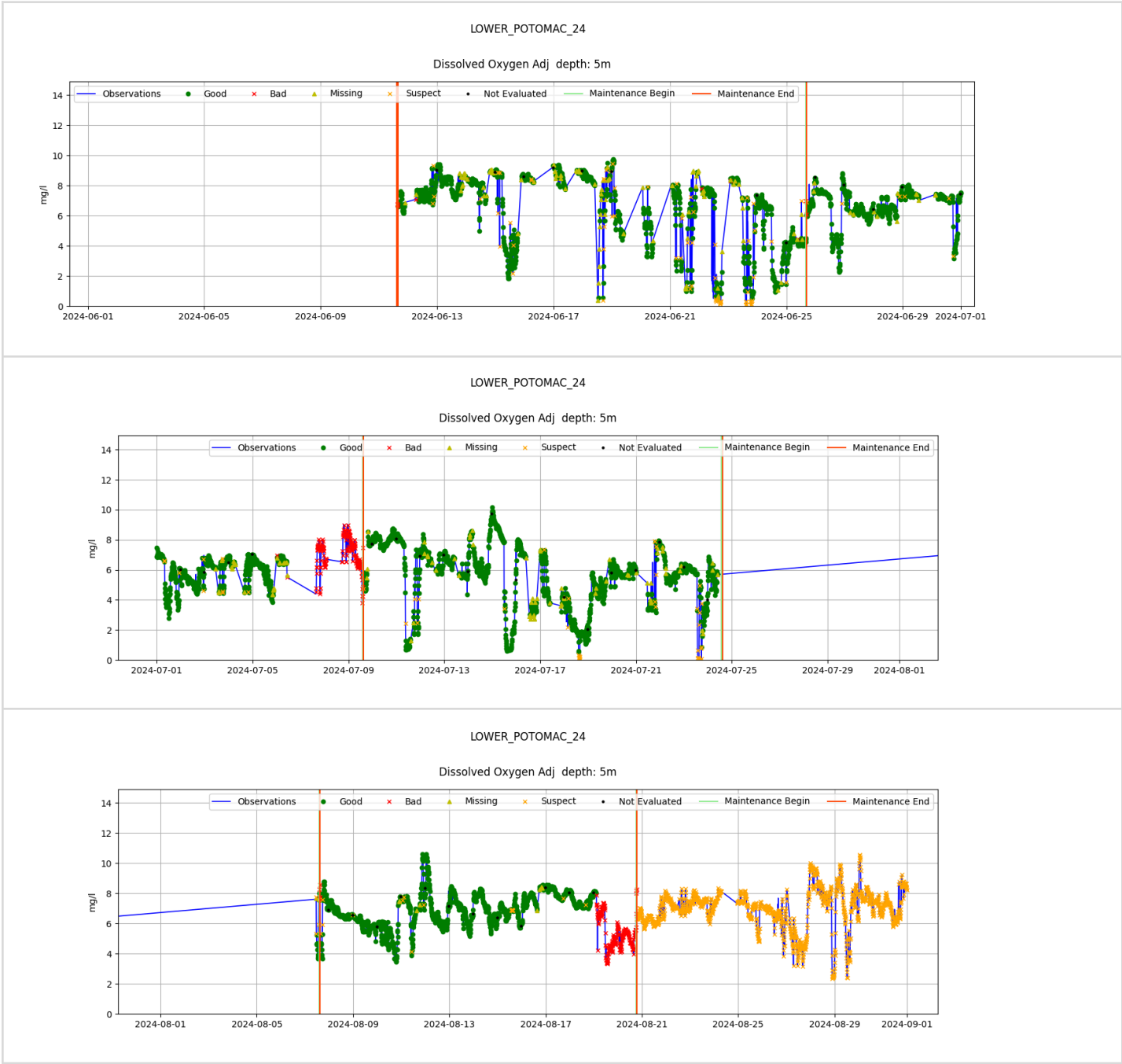


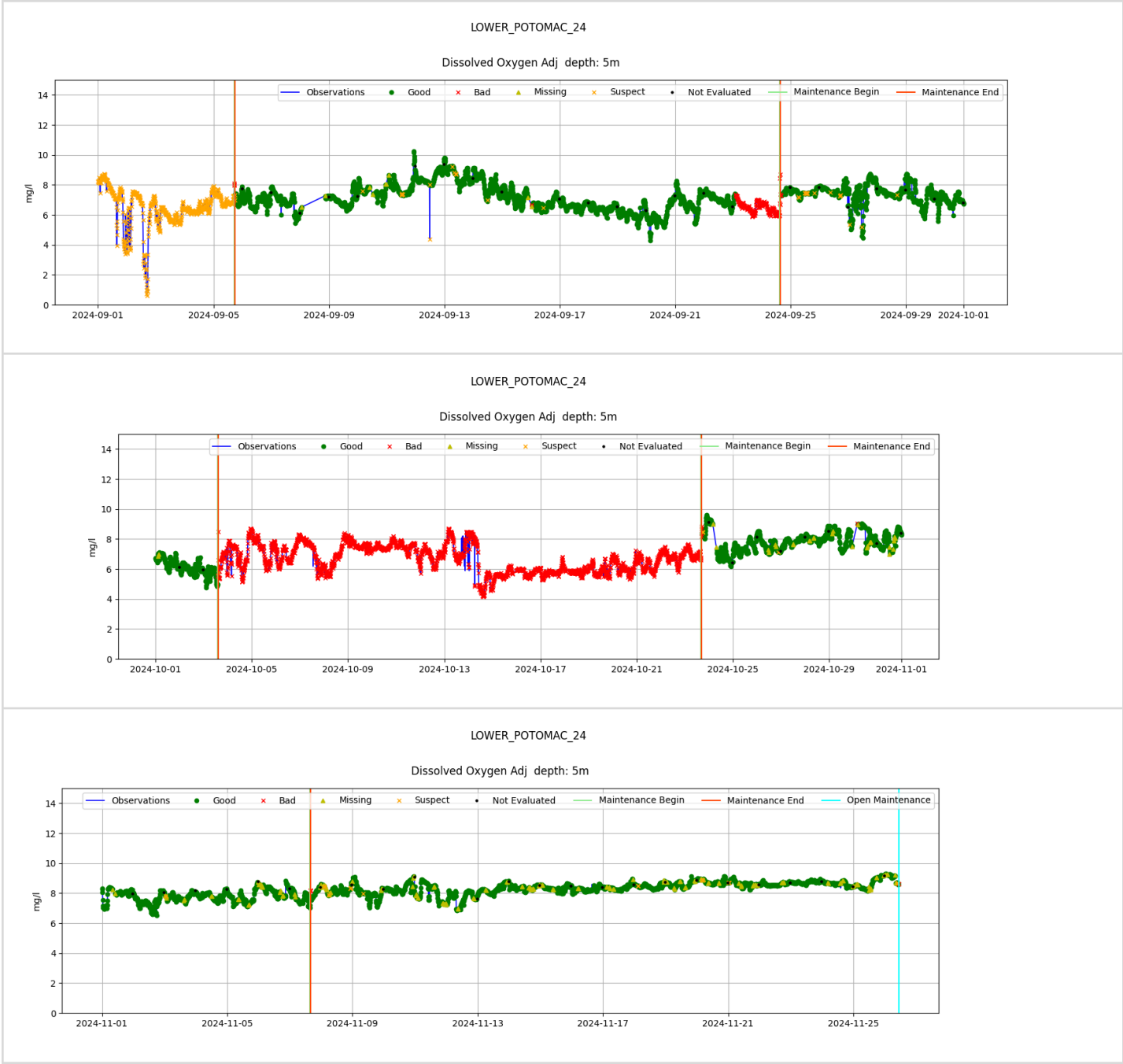
Lower Potomac 5m Water Temperature





Lower Potomac 5m Dissolved Oxygen Adjusted

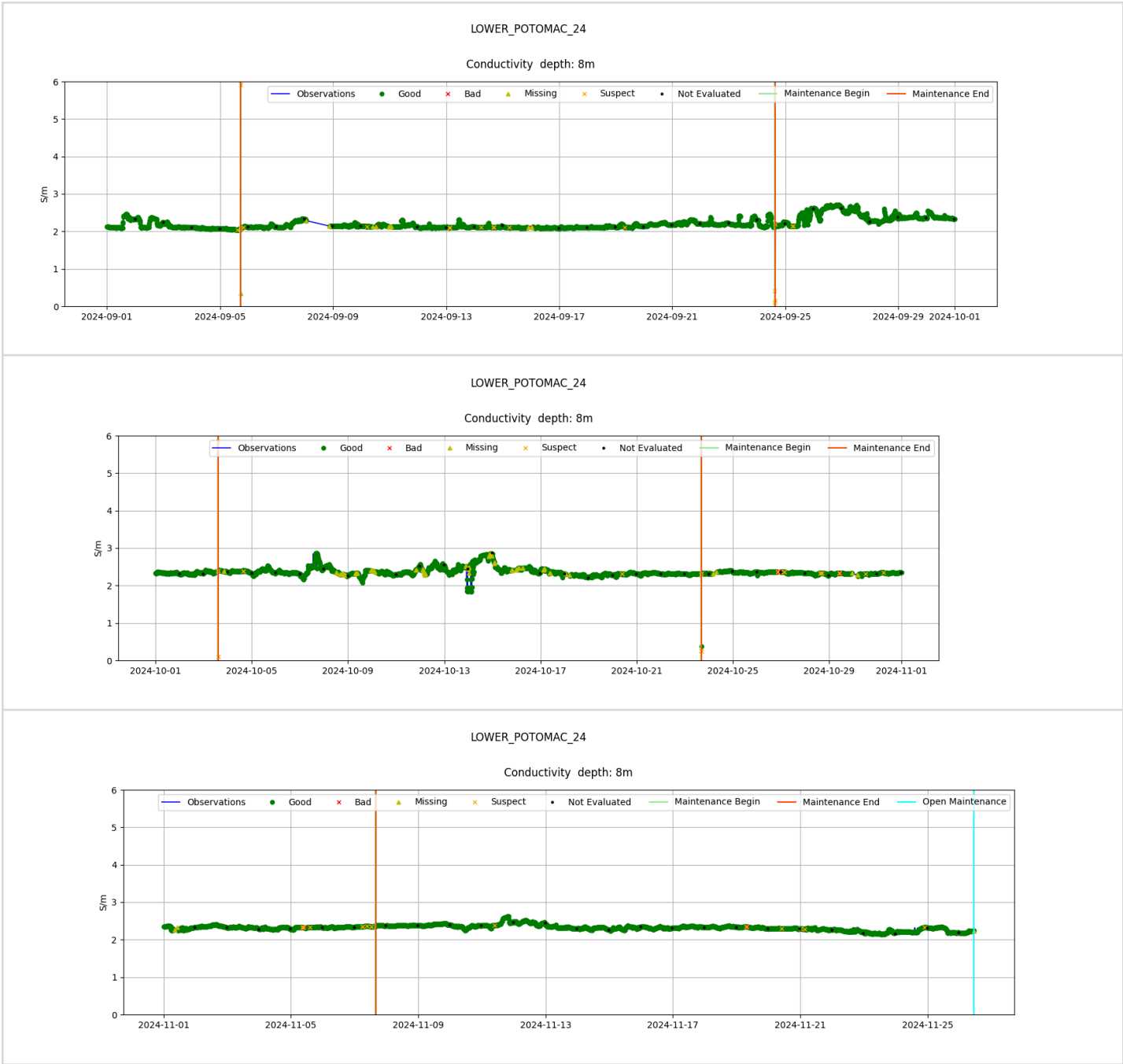




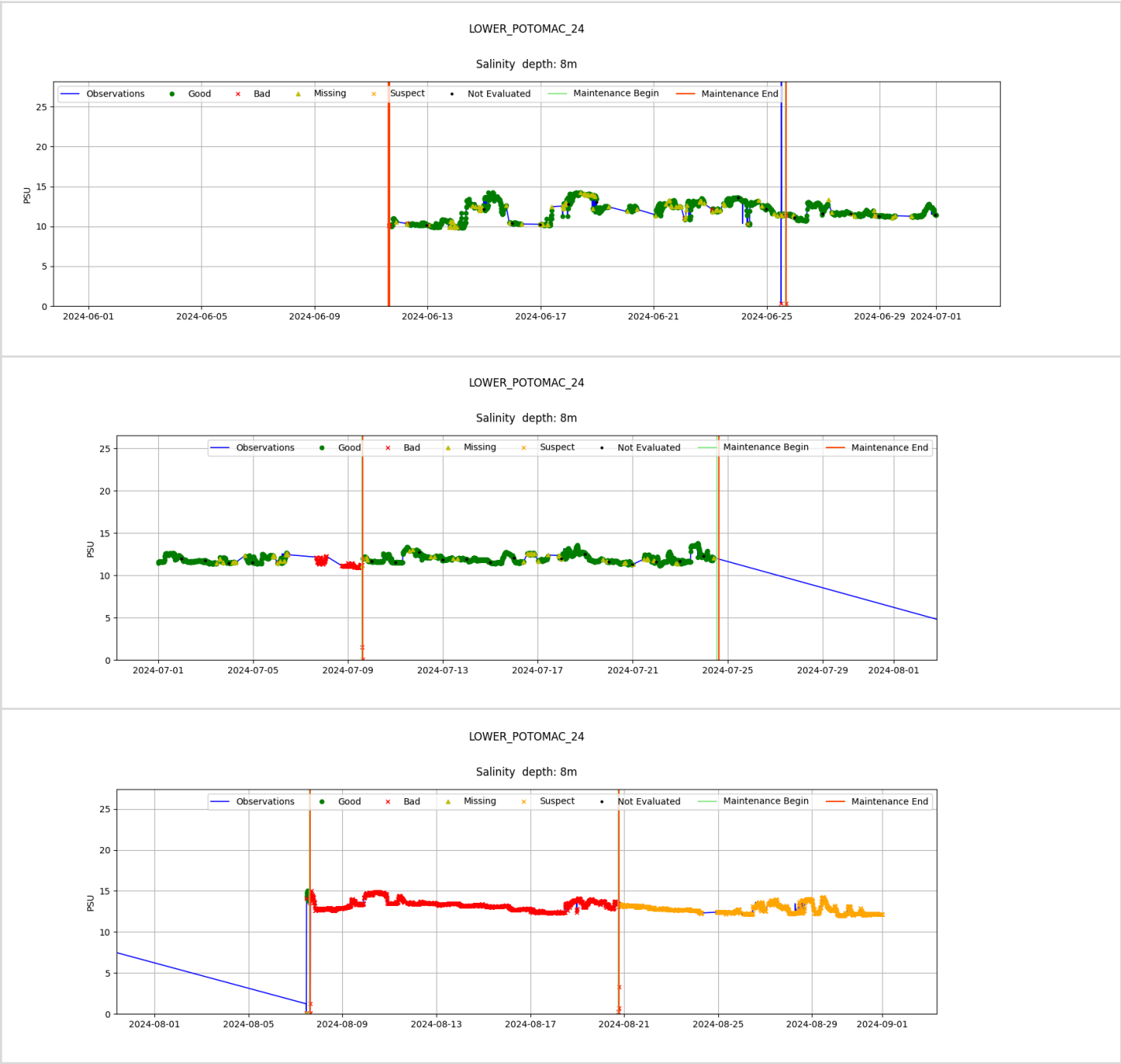
Lower Potomac 8m Conductivity





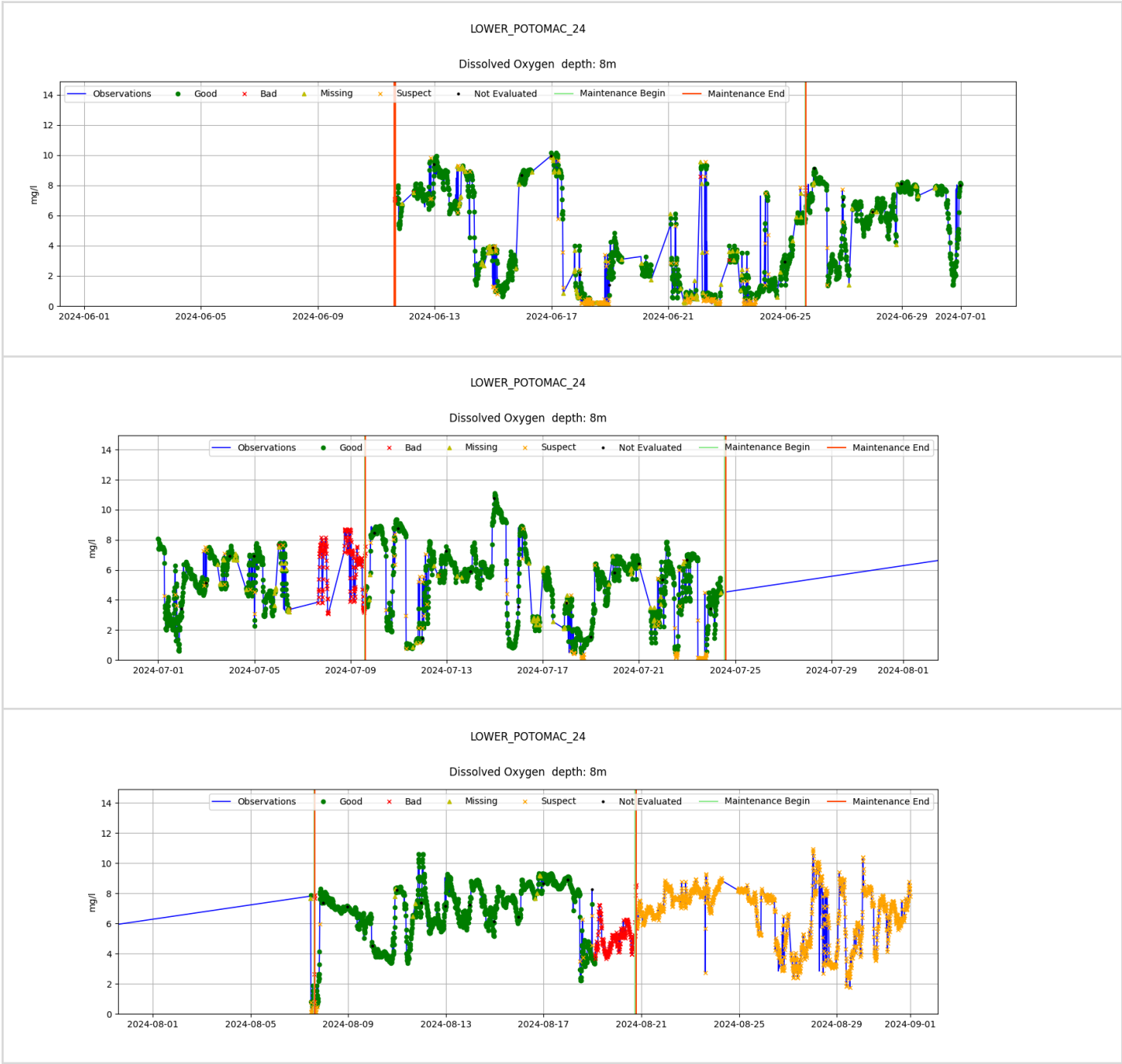


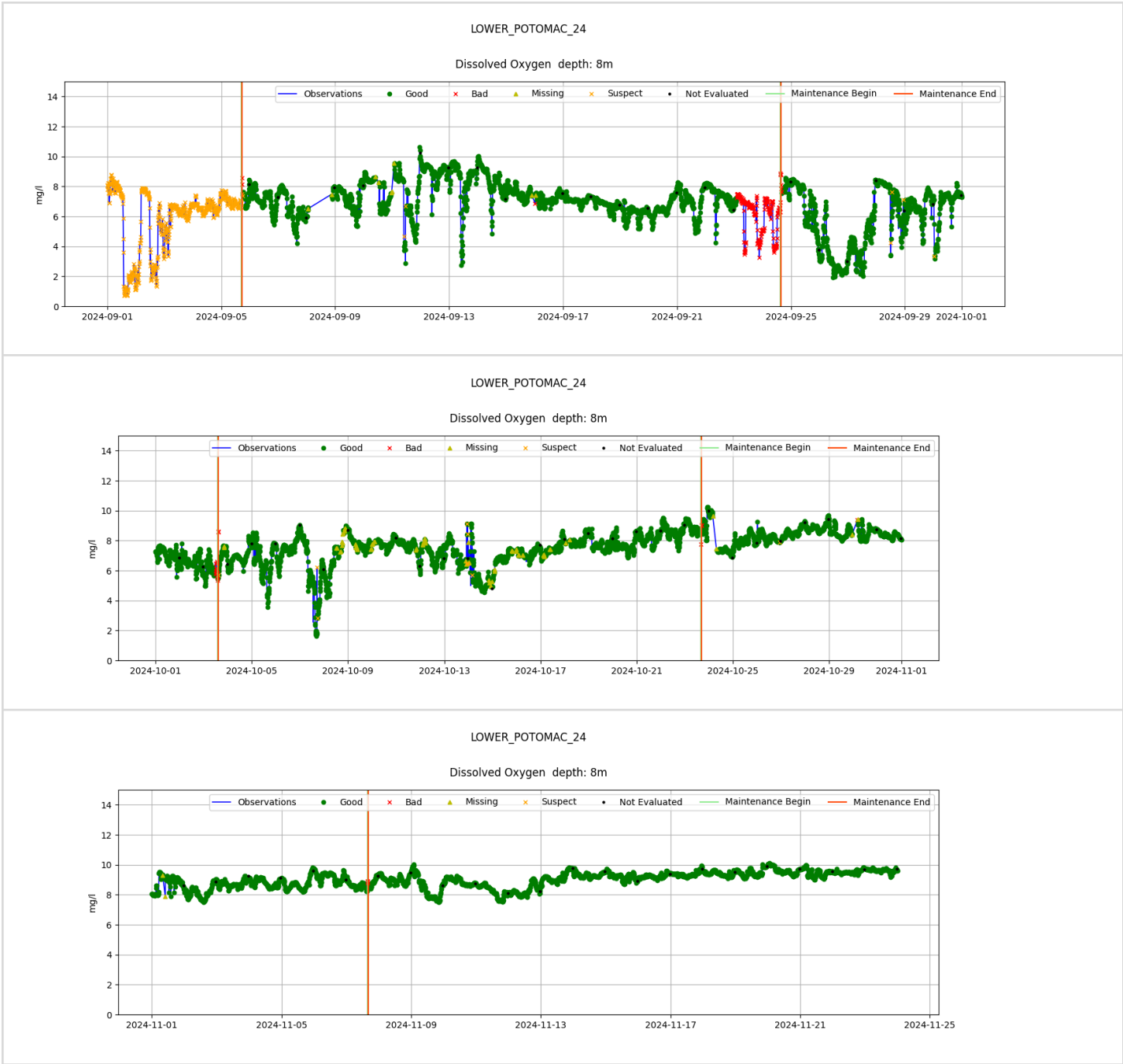
Lower Potomac 8m Salinity





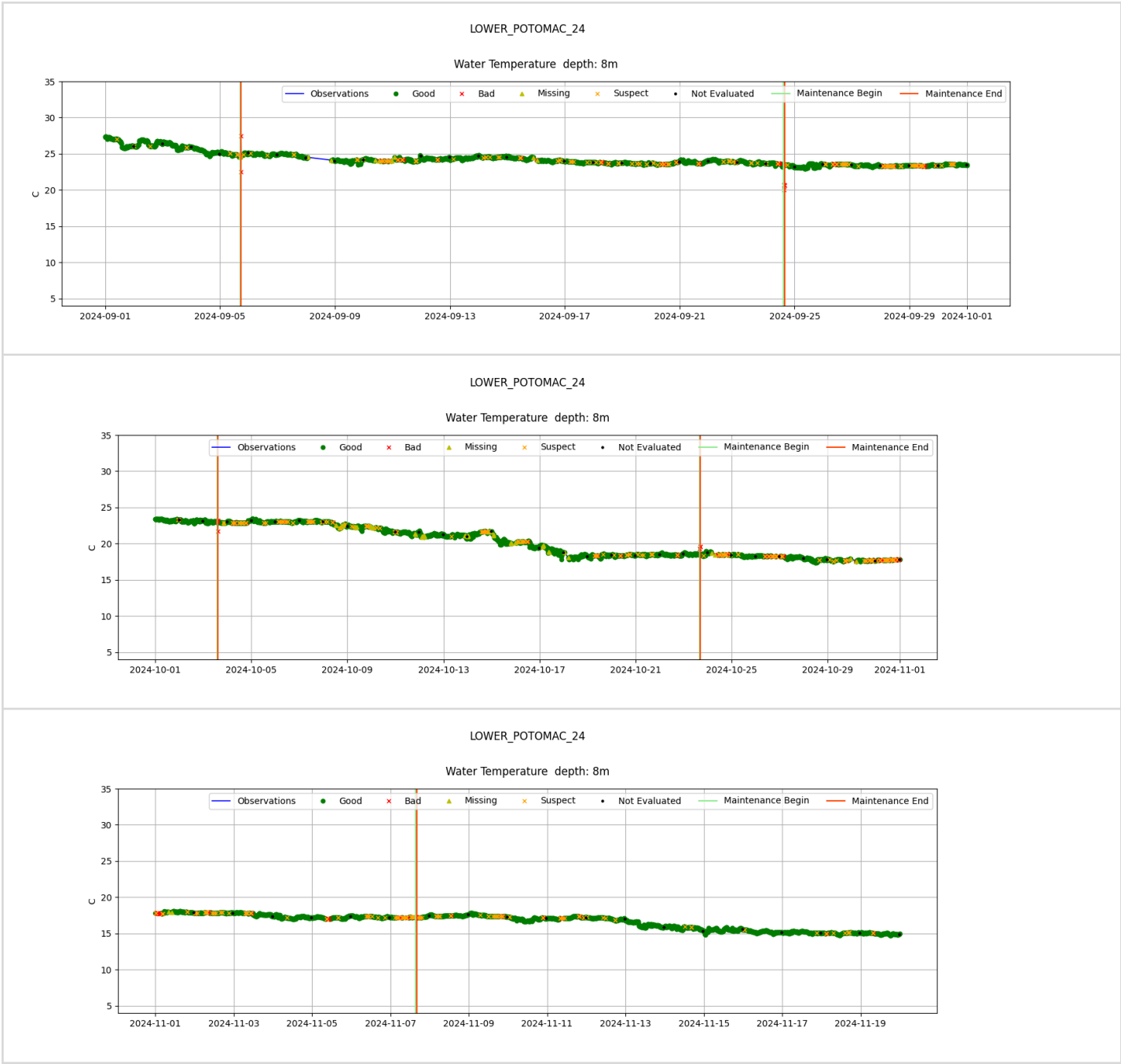
Lower Potomac 8m Dissolved Oxygen



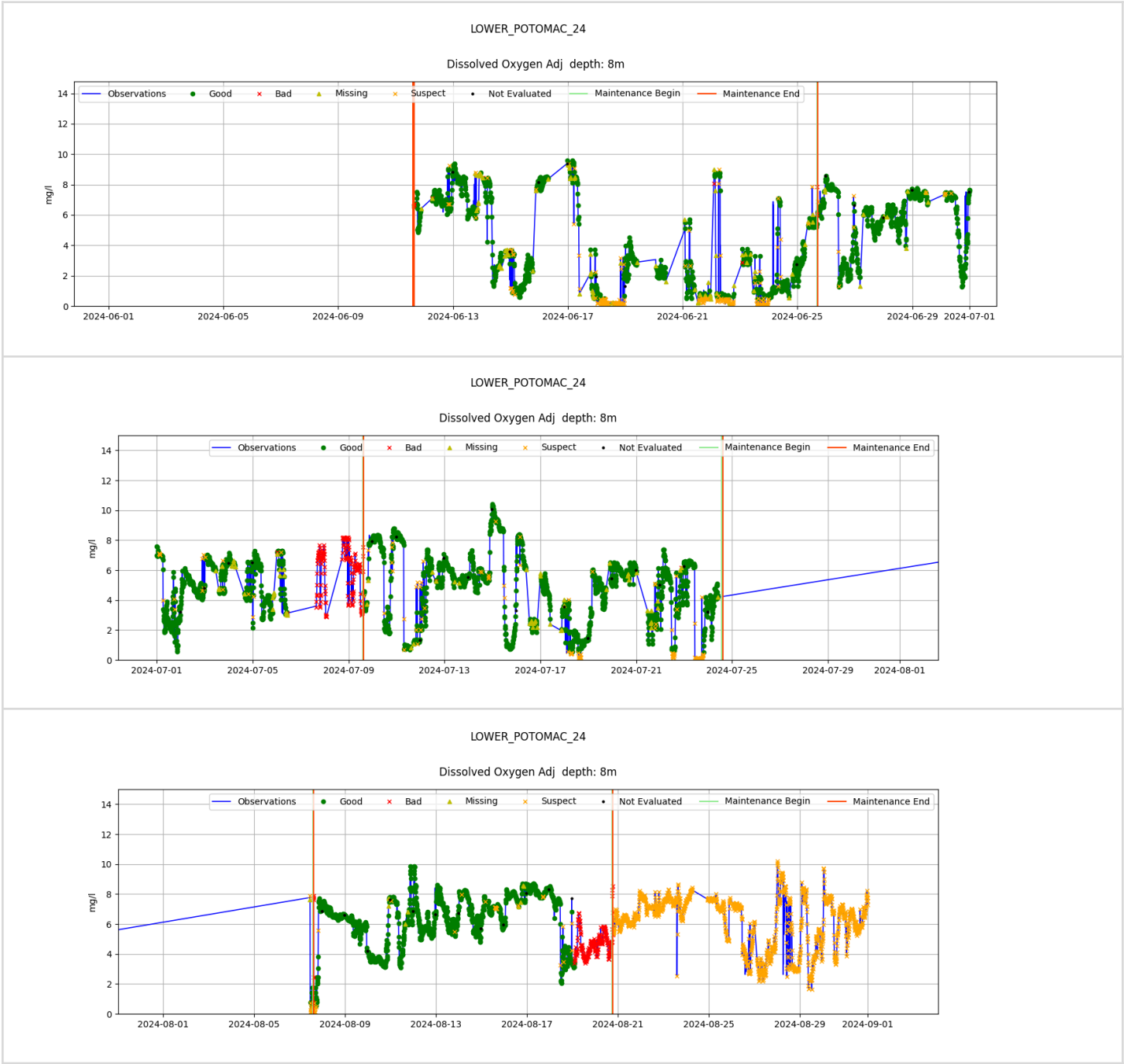


Lower Potomac 8m Water Temperature

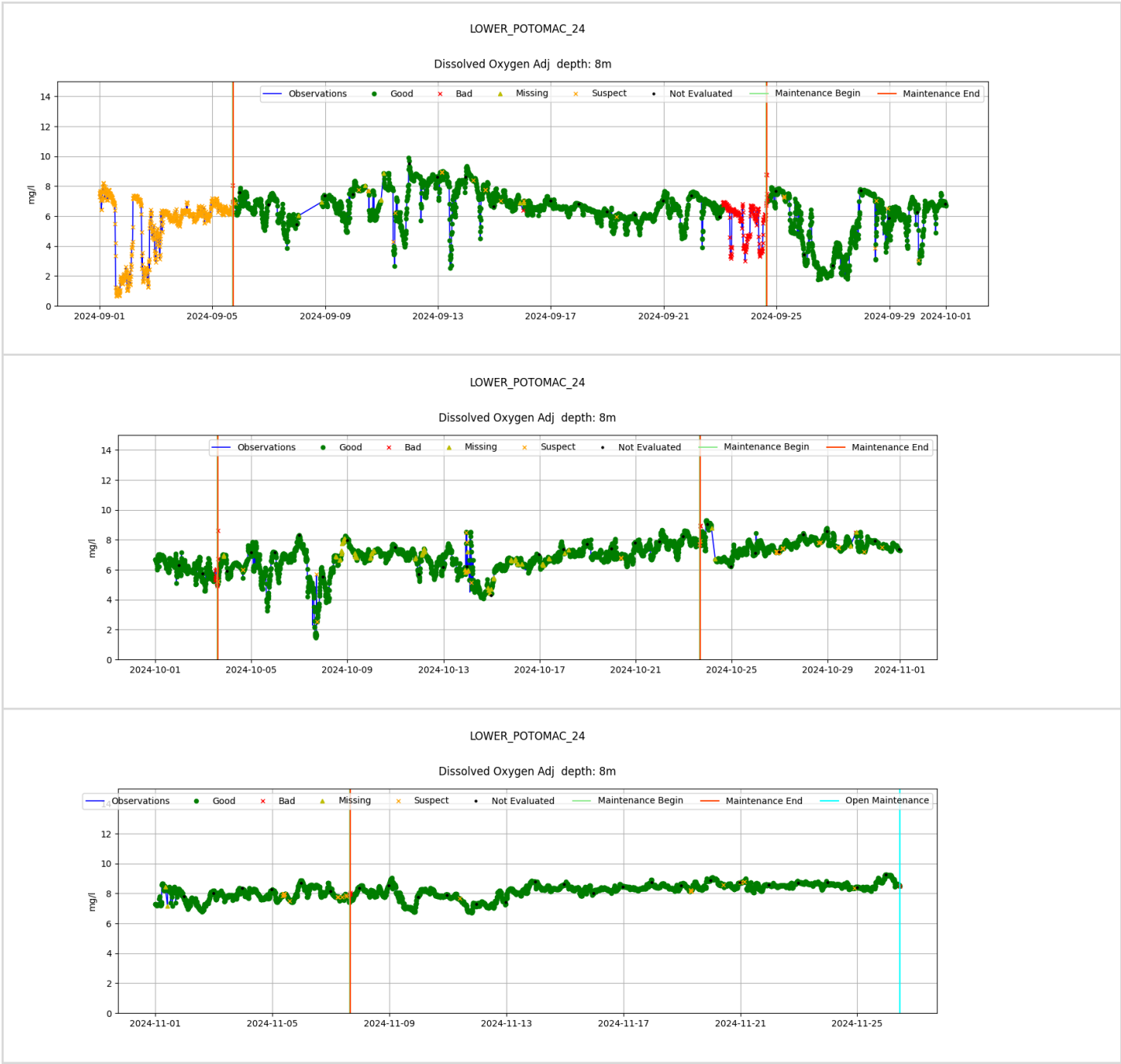




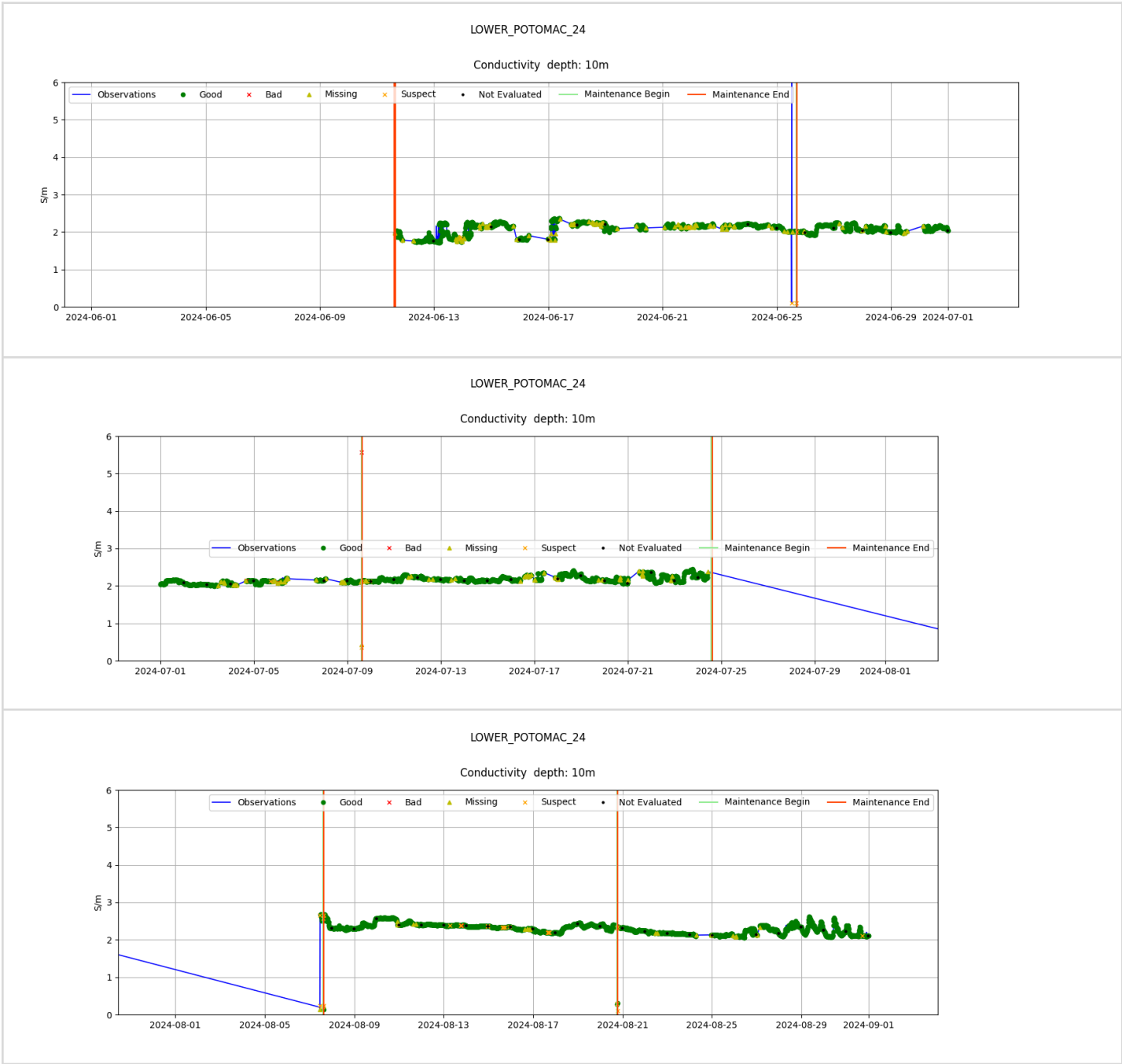
Lower Potomac 8m Dissolved Oxygen Adjusted

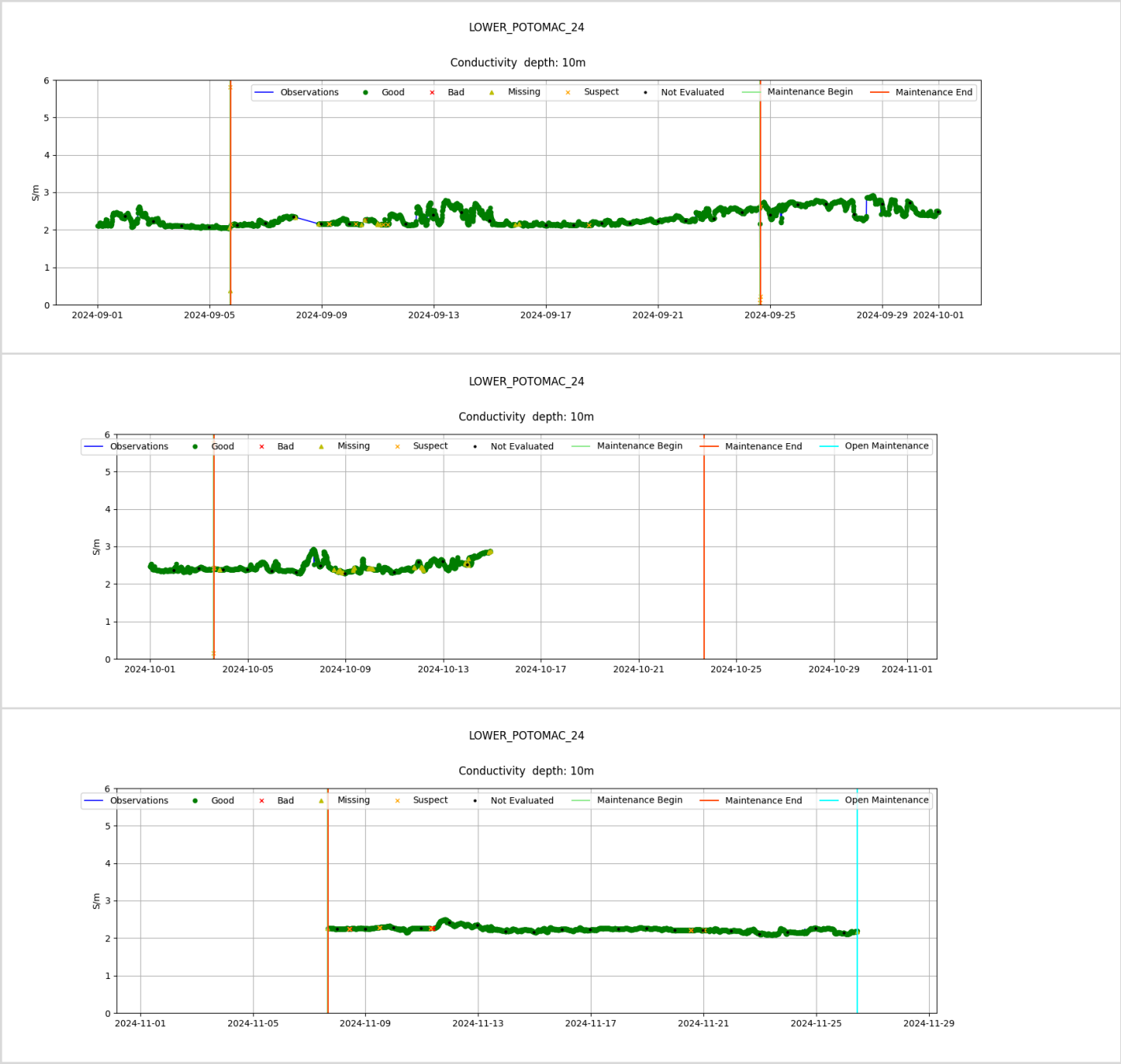




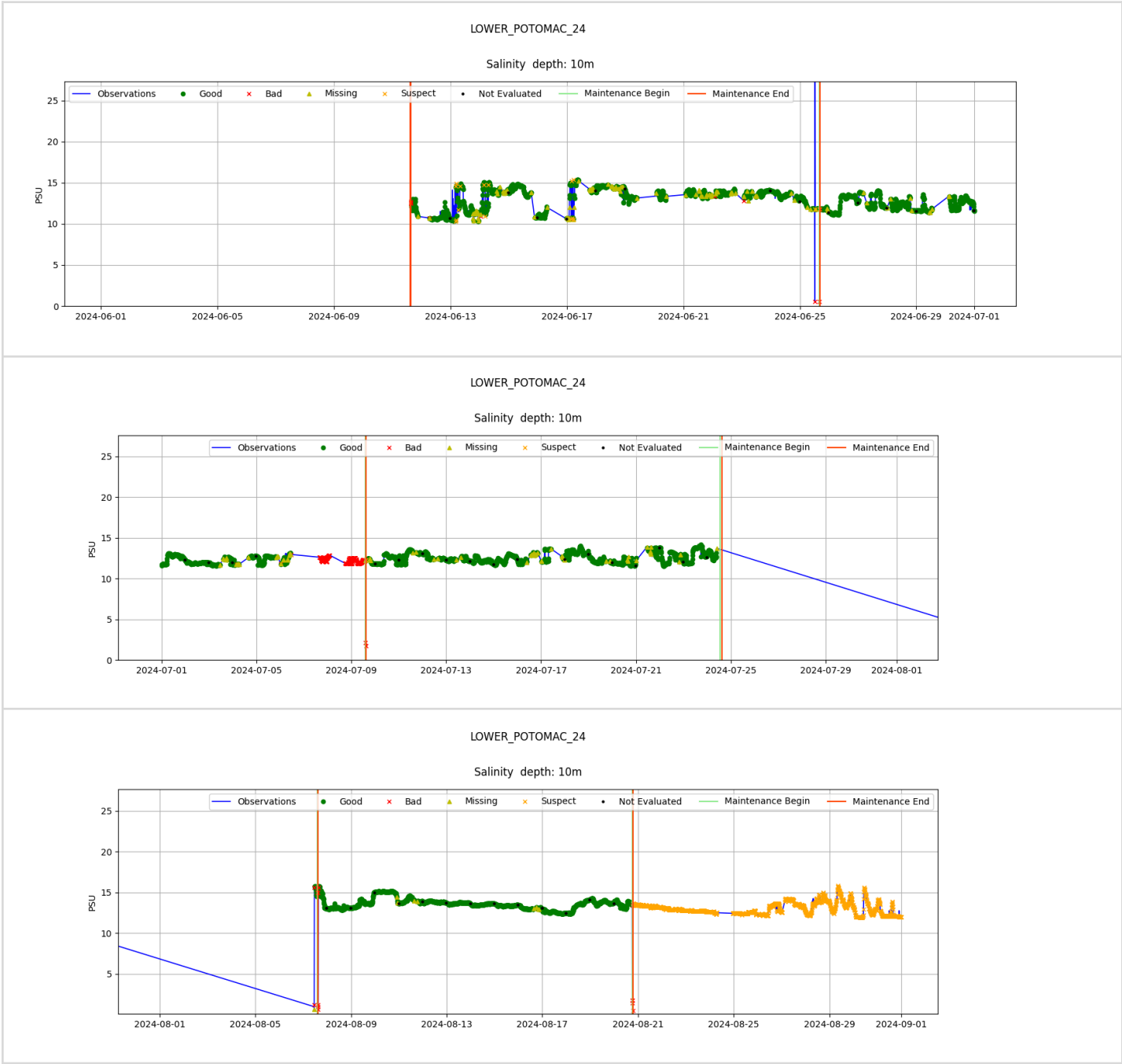


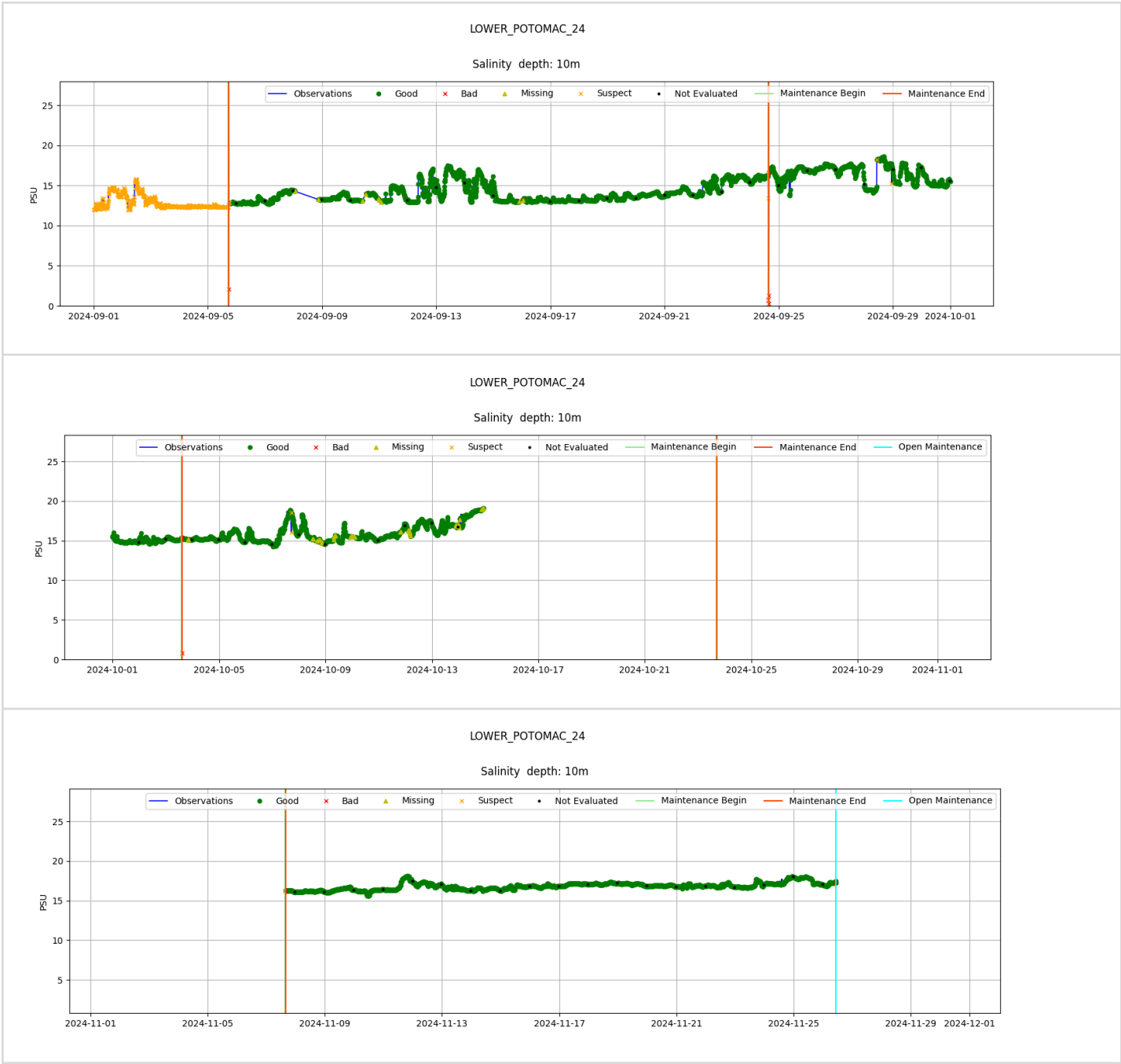
Lower Potomac 10m Conductivity



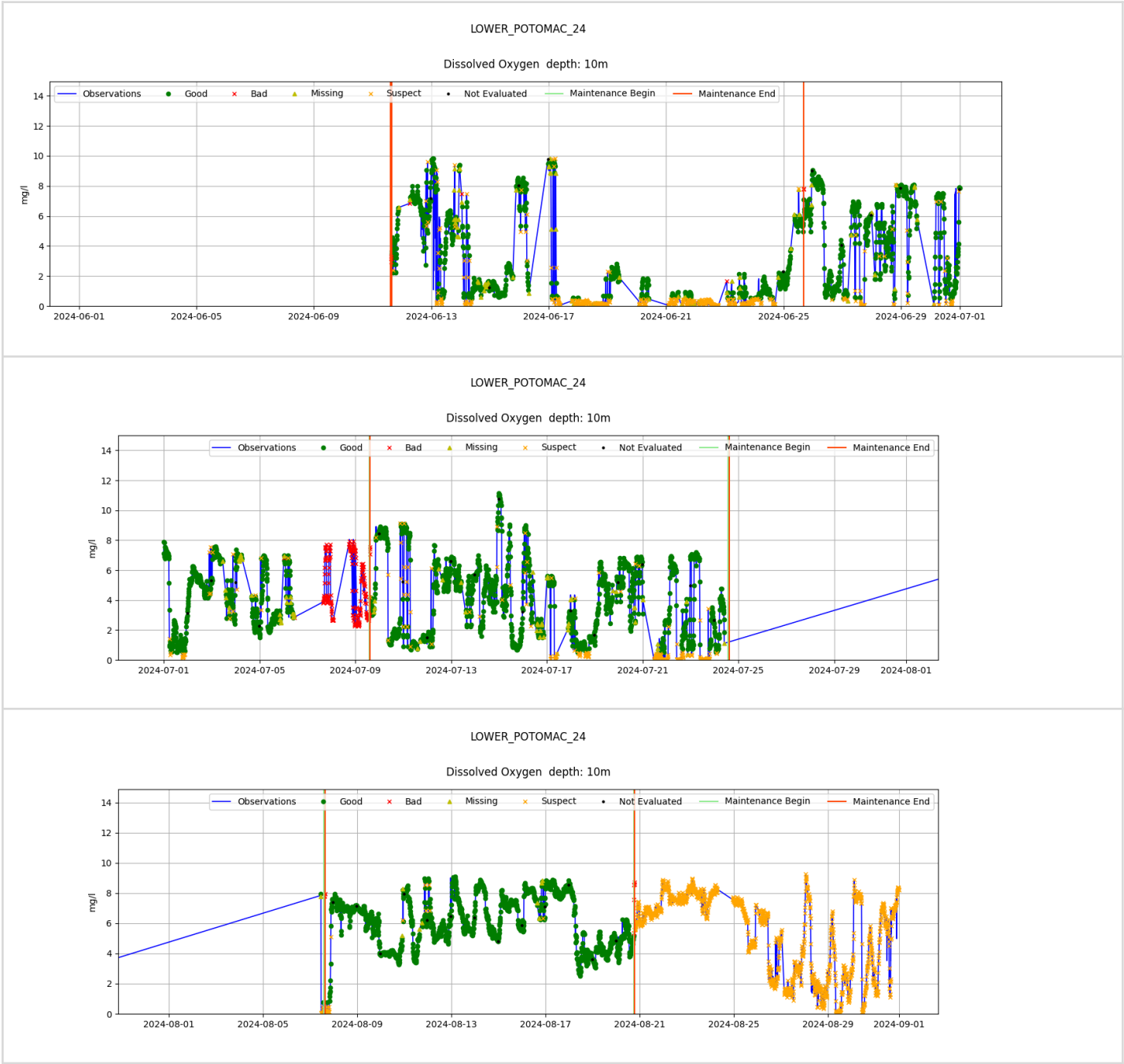


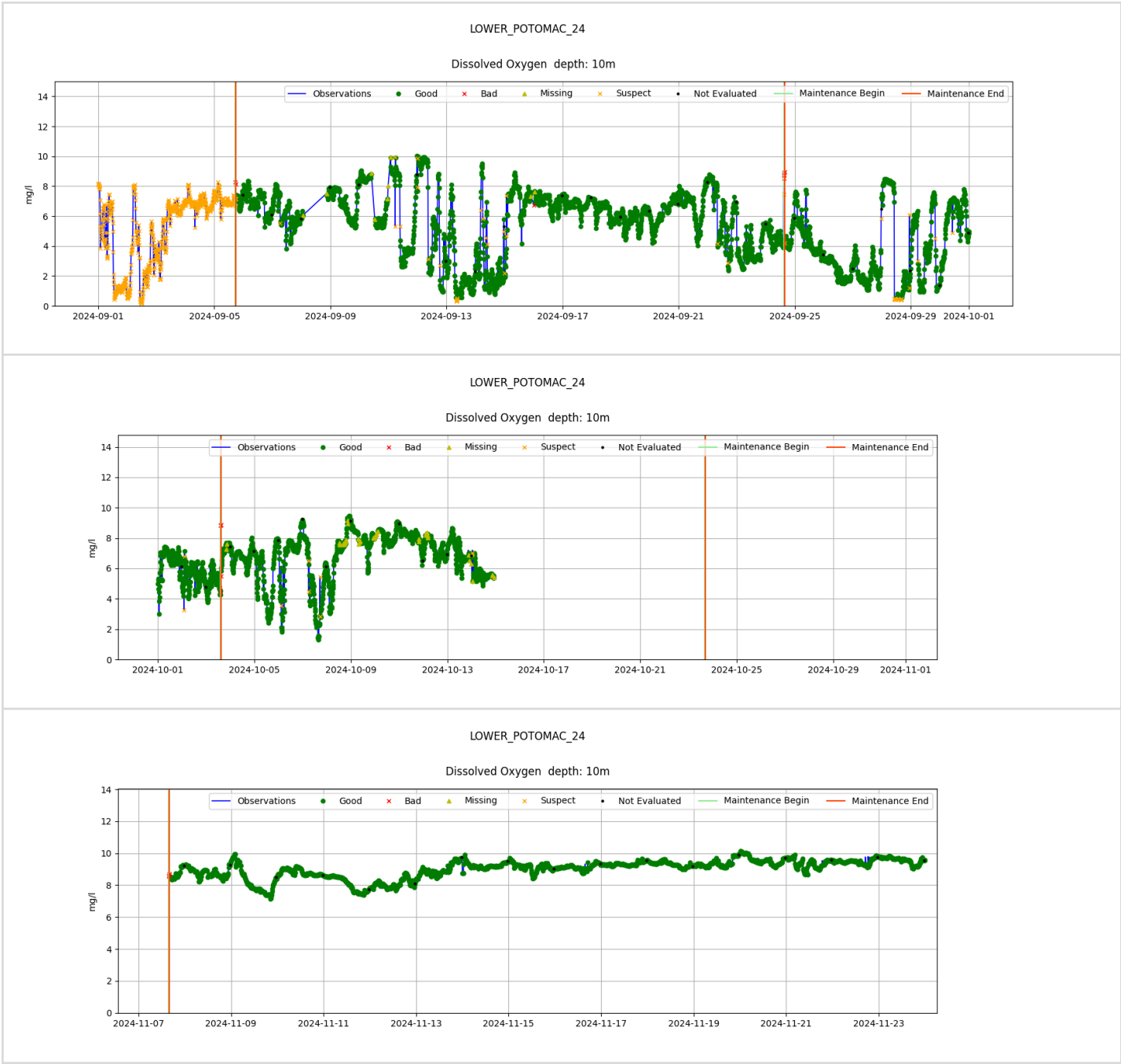
Lower Potomac 10m Salinity





Lower Potomac 10m Dissolved Oxygen

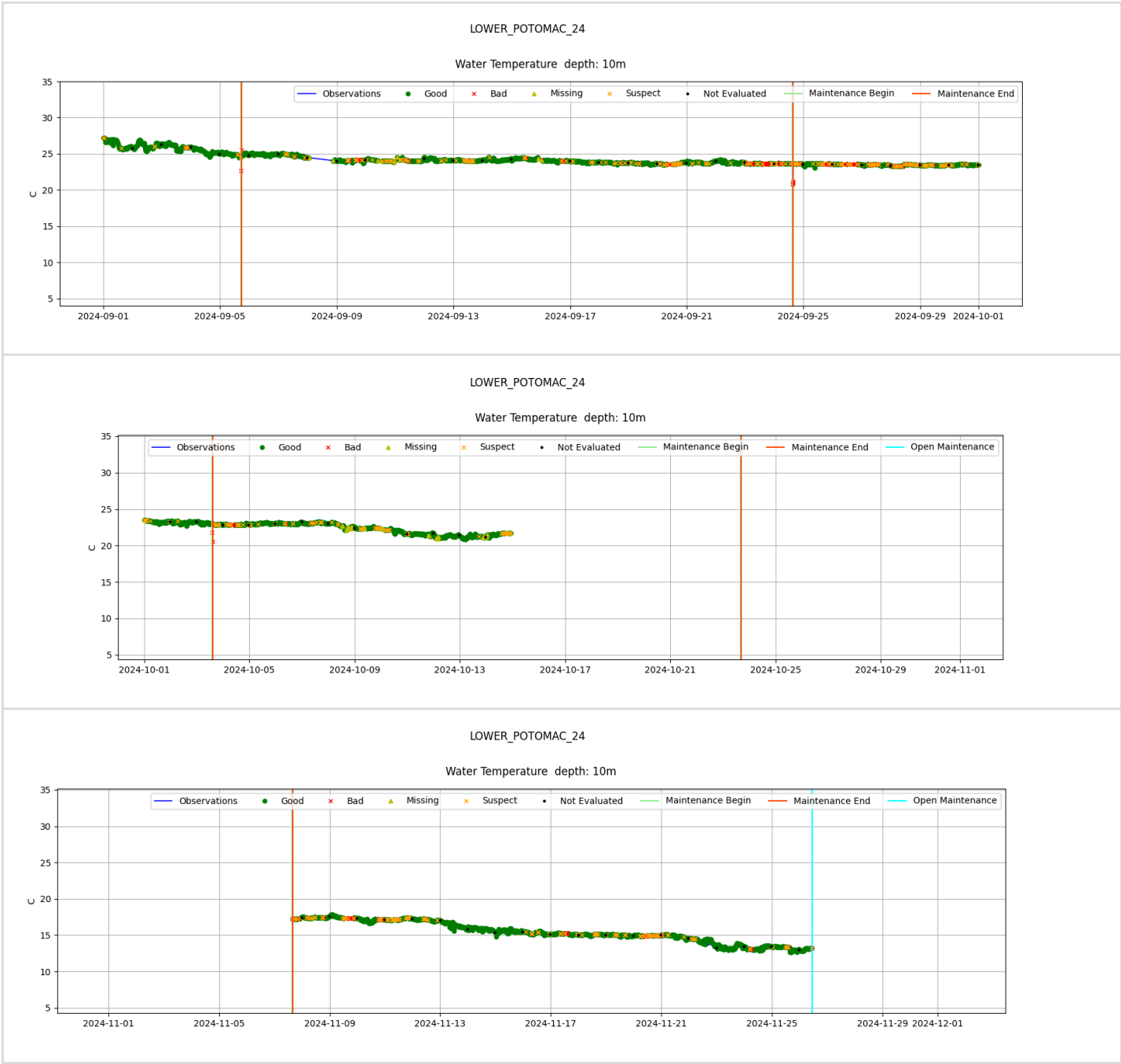




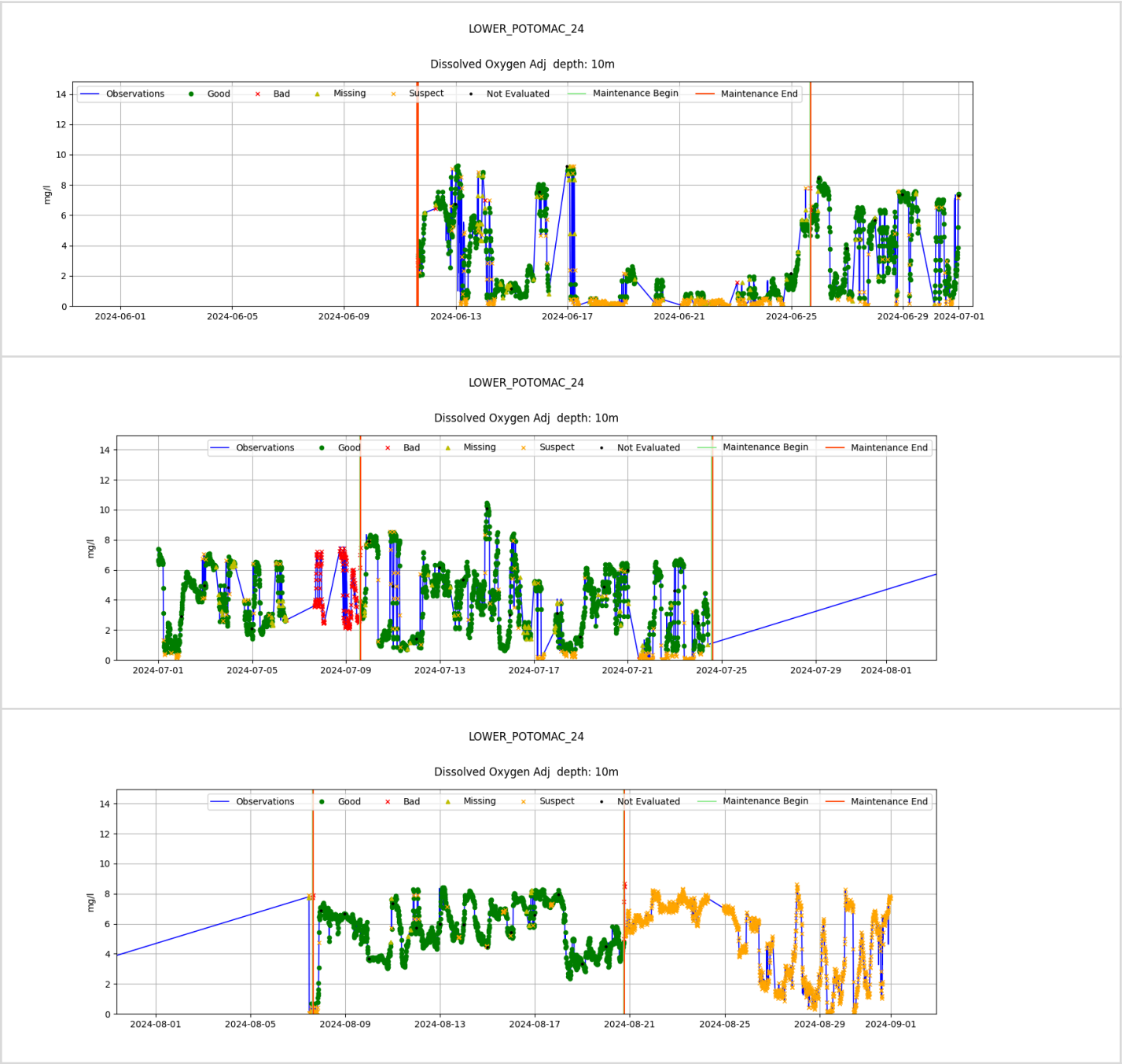
Lower Potomac 10m Water Temperature

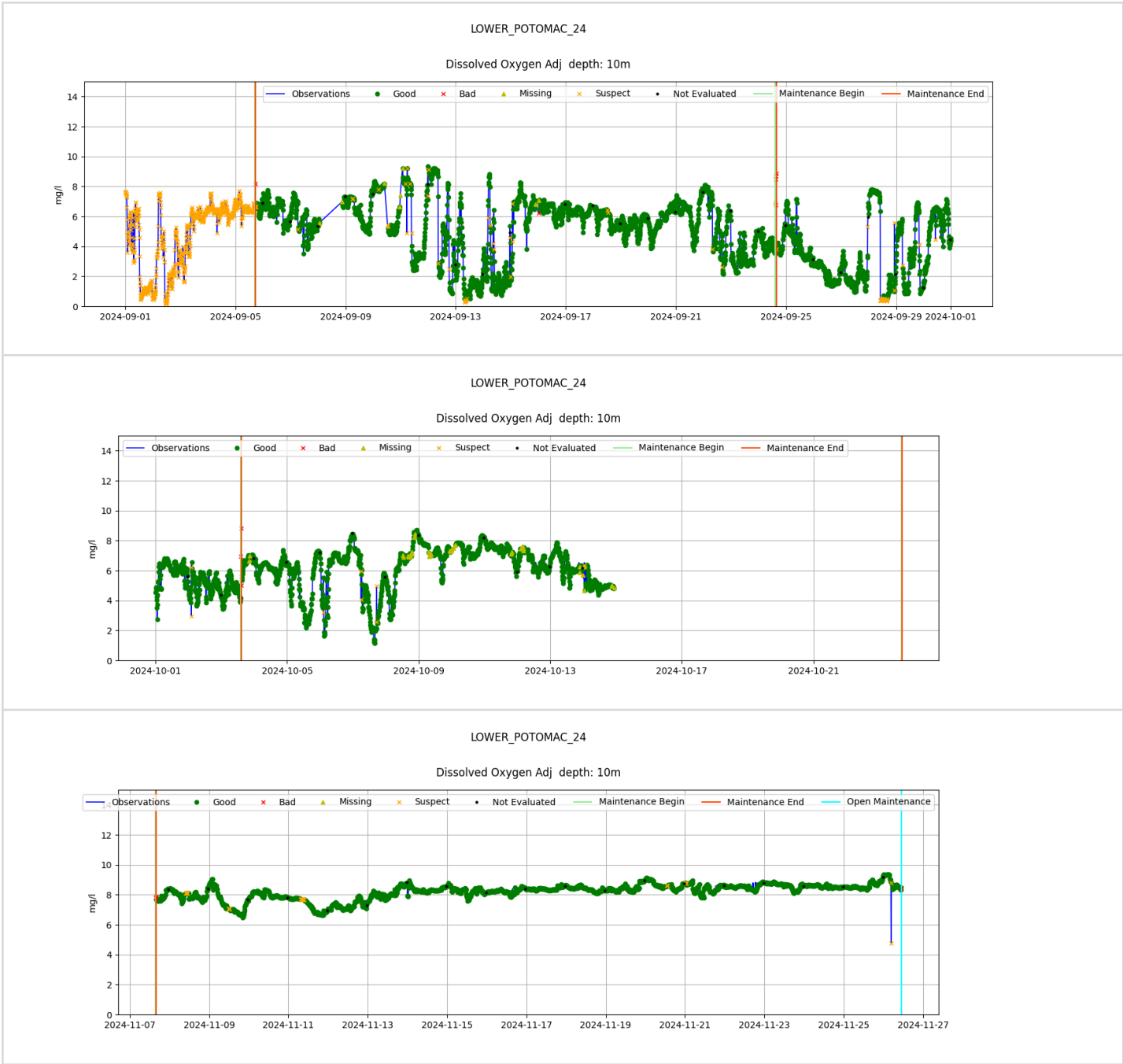






Lower Potomac 10m Dissolved Oxygen Adjusted





# Appendices

## Lower Choptank

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen	2024-01-02 10:20-0500	2024-01-09 14:50-0500	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen Adj	2024-01-02 10:20-0500	2024-01-09 14:50-0500	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	BAD	5	Salinity	2024-01-18 12:00-0500	2024-02-24 18:00-0500	Inconsistent Readings, Sudden Drops	Post Before and After CTD reads 16.6 to 19.6 on 1/18
lower-choptank	BAD	Array		2024-02-24 18:00-0500	2024-04-23 11:00-0400	Buoy Break away	Buoy out of the water
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen	2024-05-16 14:30-0400	2024-06-06 02:40-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen Adj	2024-05-16 14:30-0400	2024-06-06 02:40-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	BAD	5	Dissolved Oxygen Adj	2024-05-30 15:10-0400	2024-06-03 13:00-0400	Inconsistent Readings, Sudden Drops	CTD Maintenance pre on 6/3 is bad with a difference of -1.0
lower-choptank	BAD	Array	Dissolved Oxygen	2024-05-30 15:10-0400	2024-06-03 13:00-0400	Inconsistent Readings, Sudden Drops	CTD Maintenance pre on 6/3 is bad with a difference of -1.0
lower-choptank	BAD	Array		2024-06-03 12:02-0400	2024-06-03 13:02-0400	Maintenance	Cleaning
lower-choptank	BAD	5	Dissolved Oxygen Adj	2024-06-10 22:30-0400	2024-06-13 10:10-0400	Inconsistent Readings, Sudden Drops	
lower-choptank	BAD	5	Dissolved Oxygen	2024-06-10 22:30-0400	2024-06-13 10:10-0400	Inconsistent Readings, Sudden Drops	
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen Adj	2024-06-18 00:10-0400	2024-06-23 15:50-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	Questionable or Suspect	8	Dissolved Oxygen	2024-06-18 00:10-0400	2024-06-23 15:50-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	BAD	Array		2024-06-20 12:10-0400	2024-06-20 11:40-0400	Maintenance	Cleaning
lower-choptank	BAD	8	Dissolved Oxygen	2024-06-23 15:50-0400	2024-07-02 13:40-0400	Data Gap	No comms
lower-choptank	BAD	8	Dissolved Oxygen Adj	2024-06-23 15:50-0400	2024-07-02 13:40-0400	Data Gap	No comms
lower-choptank	BAD	Array		2024-07-02 11:52-0400	2024-07-02 12:33-0400	Maintenance	Cleaning
lower-choptank	BAD	8	Dissolved Oxygen	2024-07-02 13:33-0400	2024-07-16 11:15-0400	Bad CTD Reading	Post CTD reads -1.2 on 7/2 and -.8 on 7/16 pre
lower-choptank	BAD	8	Dissolved Oxygen Adj	2024-07-02 13:33-0400	2024-07-16 11:15-0400	Bad CTD Reading	Post CTD reads -1.2 on 7/2 and -.8 on 7/16 pre
lower-choptank	BAD	8	Dissolved Oxygen Adj	2024-07-02 13:33-0400	2024-07-16 11:15-0400	Bad CTD Reading	Post CTD reads -1.2 on 7/2 and -.8 on 7/16 pre

lower-choptank	BAD	Array		2024-07-16 10:15-0400	2024-07-16 10:47-0400	Maintenance	Cleaning
lower-choptank	Questionable or Suspect	2	Dissolved Oxygen	2024-07-16 11:47-0400	2024-08-05 12:15-0400	Inconsistent Readings, Slowly decreases	Slow decrease and Bad CTD of .8 on 7/16 and bad pre CTD on 8/13
lower-choptank	Questionable or Suspect	2	Dissolved Oxygen Adj	2024-07-16 11:47-0400	2024-08-05 12:15-0400	Inconsistent Readings, Slowly decreases	Slow decrease and Bad CTD of .8 on 7/16 and bad pre CTD on 8/13
lower-choptank	BAD	5	Dissolved Oxygen	2024-07-26 17:20-0400	2024-08-05 12:10-0400	Inconsistent Readings, Sudden Drops	Sudden Decrease which leads to a CTD pre of -3.5 difference on 8/5
lower-choptank	BAD	5	Dissolved Oxygen Adj	2024-07-26 17:20-0400	2024-08-05 12:10-0400	Inconsistent Readings, Sudden Drops	Sudden Decrease which leads to a CTD pre of -3.5 difference on 8/5
lower-choptank	BAD	Array		2024-08-05 11:15-0400	2024-08-05 11:44-0400	Maintenance	Cleaning
lower-choptank	BAD	2	Dissolved Oxygen	2024-08-05 12:44-0400	2024-08-13 11:34-0400	Inconsistent Readings, Slowly decreases	Constant decrease and Bad CTD of -.5.9 on 8/13 pre
lower-choptank	BAD	2	Dissolved Oxygen Adj	2024-08-05 12:44-0400	2024-08-13 11:34-0400	Inconsistent Readings, Slowly decreases	Constant decrease and Bad CTD of -.5.9 on 8/13 pre
lower-choptank	BAD	2	Dissolved Oxygen Adj	2024-08-05 12:44-0400	2024-08-13 11:34-0400	Inconsistent Readings, Slowly decreases	Constant decrease and Bad CTD of -.5.9 on 8/13 pre
lower-choptank	BAD	Array		2024-08-13 10:34-0400	2024-08-13 11:11-0400	Maintenance	Cleaning
lower-choptank	BAD	Array		2024-08-13 10:34-0400	2024-08-13 11:11-0400	Maintenance	Cleaning
lower-choptank	BAD	Array		2024-08-27 11:15-0400	2024-08-27 11:41-0400	Maintenance	Cleaning
lower-choptank	BAD	2	Dissolved Oxygen	2024-09-09 13:40-0400	2024-09-10 11:30-0400	Inconsistent Readings, Sudden Drops	Rapid decrease to the next maintenance 9/10 with a pre CTD difference of -.5.6
lower-choptank	BAD	2	Dissolved Oxygen Adj	2024-09-09 13:40-0400	2024-09-10 11:30-0400	Inconsistent Readings, Sudden Drops	Rapid decrease to the next maintenance 9/10 with a pre CTD difference of -.5.6
lower-choptank	BAD	2	Dissolved Oxygen Adj	2024-09-09 13:40-0400	2024-09-10 11:30-0400	Inconsistent Readings, Sudden Drops	Rapid decrease to the next maintenance 9/10 with a pre CTD difference of -.5.6
lower-choptank	BAD	Array		2024-09-10 10:34-0400	2024-09-10 11:06-0400	Maintenance	Cleaning
lower-choptank	BAD	8	Salinity	2024-09-10 11:30-0400	2024-10-08 11:16-0400	Bad CTD Reading	High CTD difference readings

lower-choptank	BAD	8	Conductivity	2024-09-10 12:06-0400	2024-10-08 11:16-0400	Inconsistent Readings	Bad CTD Readings
lower-choptank	BAD	8	Salinity	2024-09-10 13:06-0400	2024-10-08 12:16-0400	Conductivity is Bad	Conductivity Status Bad
lower-choptank	BAD	5	Salinity	2024-09-20 23:40-0400	2024-10-08 11:16-0400	Bad CTD Reading	Bad CTD Readings, salinity reading stays constant at 12psu for a long time frame, no slight fluctuations
lower-choptank	BAD	Array		2024-09-23 12:20-0400	2024-09-23 12:40-0400	Maintenance	Cleaning
lower-choptank	BAD	Array		2024-10-08 10:16-0400	2024-10-08 10:45-0400	Maintenance	Cleaning
lower-choptank	Questionable or Suspect	5	Dissolved Oxygen	2024-10-11 01:10-0400	2024-10-11 21:30-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	Questionable or Suspect	5	Dissolved Oxygen Adj	2024-10-11 01:10-0400	2024-10-11 21:30-0400	Inconsistent Readings, Sudden Drops	Alot of variability within a short time frame
lower-choptank	BAD	Array		2024-10-29 11:49-0400	2024-10-29 12:08-0400	Maintenance	Cleaning
lower-choptank	BAD	Array		2024-11-14 10:06-0500	2024-11-14 10:23-0500	Maintenance	Cleaning
lower-choptank	BAD	Array		2024-12-10 09:43-0500	2024-12-10 10:54-0500	Maintenance	Cleaning

Chlora Point

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
chlora-point	BAD	5	Dissolved Oxygen	2024-06-01 21:00-0400	2024-06-03 10:00-0400	Sensor started to decline	Failed Pre-ctd cast on 6/3 by 2.07mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-06-01 21:00-0400	2024-06-03 10:00-0400	Sensor started to decline	Failed Pre-ctd cast on 6/3 by 2.07mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	Array		2024-06-03 10:00-0400	2024-06-03 11:06-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-06-03 10:00-0400	2024-06-03 11:06-0400	Maintenance	Cleaning
chlora-point	BAD	5	Dissolved Oxygen	2024-06-14 19:50-0400	2024-06-20 13:20-0400	Sensor started to decline	Failed Pre-ctd cast on 6/20 by 5.04mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-06-14 19:50-0400	2024-06-20 13:20-0400	Sensor started to decline	Failed Pre-ctd cast on 6/20 by 5.04mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen	2024-06-18 19:40-0400	2024-06-20 14:21-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 6/20, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen Adj	2024-06-18 19:40-0400	2024-06-20 14:21-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 6/20, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	Array		2024-06-20 13:30-0400	2024-06-20 14:21-0400	Maintenance	Cleaning
chlora-point	Questionable or Suspect	2	Water Temperature	2024-06-20 14:32-0400	2024-07-02 14:08-0400	Failed CTD Cast	Failed post ctd cast on 6/2 by 0.03C and failed the pre-ctd cast on 7/2 by 0.41c. Due to the small amount of error we changed this from bad to suspect
chlora-point	BAD	2	Water Temperature	2024-06-20 14:32-0400	2024-07-02 14:08-0400	Failed CTD Cast	Bad data
chlora-point	BAD	5	Dissolved Oxygen	2024-06-21 02:30-0400	2024-07-02 13:10-0400	Sensor started to decline	Failed Pre-ctd cast on 7/2 by 5.16mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-06-21 02:30-0400	2024-07-02 13:10-0400	Sensor started to decline	Failed Pre-ctd cast on 7/2 by 5.16mg/L, had started to decline due to biofouling as see in photos. Passed Post cleaning ctd
chlora-point	BAD	8	Dissolved Oxygen	2024-06-30 00:00-0400	2024-07-02 13:10-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 7/2, biofouling was extensive from photos. Passed post cleaning ctd
chlora-point	BAD	8	Dissolved Oxygen Adj	2024-06-30 00:00-0400	2024-07-02 13:10-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 7/2, biofouling was extensive from photos. Passed post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen	2024-06-30 17:30-0400	2024-07-02 14:10-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 7/2, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen Adj	2024-06-30 17:30-0400	2024-07-02 14:10-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 7/2, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	Array		2024-07-02 13:19-0400	2024-07-02 13:55-0400	Maintenance	Cleaning
chlora-point	Questionable or Suspect	2	Water Temperature	2024-07-02 14:08-0400	2024-07-16 12:30-0400	Suspect data	Passed on another date
chlora-point	BAD	Array		2024-07-16 11:35-0400	2024-07-16 12:11-0400	Maintenance	Cleaning
chlora-point	BAD	2	Dissolved Oxygen	2024-08-04 04:40-0400	2024-08-05 13:40-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 8/5, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen Adj	2024-08-04 04:40-0400	2024-08-05 13:40-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 8/5, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	5	Dissolved Oxygen	2024-08-04 19:50-0400	2024-08-05 12:50-0400	Sensor started to decline	Challenging to see where exactly to start flag, failed pre CTD cast on 8/5 by 5 mg/L. Passed Post
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-08-04 19:50-0400	2024-08-05 12:50-0400	Sensor started to decline	Challenging to see where exactly to start flag, failed pre CTD cast on 8/5 by 5 mg/L. Passed Post
chlora-point	BAD	Array		2024-08-05 13:00-0400	2024-08-05 13:39-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-08-13 12:11-0400	2024-08-13 12:34-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-08-13 12:11-0400	2024-08-13 12:34-0400	Maintenance	Cleaning
chlora-point	BAD	5	Dissolved Oxygen	2024-08-25 19:50-0400	2024-08-27 12:40-0400	Sensor started to decline	Failed Pre-ctd cast on 8/27, had started to decline due to biofouling.
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-08-25 19:50-0400	2024-08-27 12:40-0400	Sensor started to decline	Failed Pre-ctd cast on 8/27, had started to decline due to biofouling.
chlora-point	BAD	Array		2024-08-27 12:41-0400	2024-08-27 13:06-0400	Maintenance	Cleaning
chlora-point	BAD	2	Dissolved Oxygen	2024-09-02 15:20-0400	2024-09-10 12:40-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 9/10, sensor was reading nearly zero by the time of service, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd

chlora-point	BAD	5	Dissolved Oxygen	2024-09-02 15:20-0400	2024-09-10 13:40-0400	Sensor started to decline	Failed Pre-ctd cast on 9/10, had started to decline due to biofouling. Other sensors started to decline as well
chlora-point	BAD	5	Dissolved Oxygen Adj	2024-09-02 15:20-0400	2024-09-10 13:40-0400	Sensor started to decline	Failed Pre-ctd cast on 9/10, had started to decline due to biofouling. Other sensors started to decline as well
chlora-point	BAD	Array		2024-09-10 12:19-0400	2024-09-10 12:40-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-09-23 13:42-0400	2024-09-23 13:54-0400	Maintenance	Cleaning
chlora-point	BAD	2	Dissolved Oxygen	2024-10-07 19:40-0400	2024-10-08 10:20-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 10/8, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	2	Dissolved Oxygen Adj	2024-10-07 19:40-0400	2024-10-08 10:20-0400	Sensor started to decline	Failed Pre-cleaning ctd cast on 10/8, biofouling was extensive from photos and drift of DO readings was an outlier from the other sensors. Passed post cleaning ctd
chlora-point	BAD	Array		2024-10-08 08:40-0400	2024-10-08 09:07-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-10-29 10:40-0400	2024-10-29 11:10-0400	Maintenance	Cleaning
chlora-point	BAD	Array		2024-11-14 11:30-0500	2024-12-31 23:59-0500	End of 2024 season	Removed from water

Sharps Island

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
sharps-island	unknown	Array		2023-12-31 23:00-0500	2024-05-08 12:47-0400	Pre-deployment data	bad data
sharps-island	Questionable or Suspect	2	Water Temperature	2024-06-03 10:20-0400	2024-06-03 13:40-0400	Failed pre CTD	Failed pre CTD on 6/3 by 0.32C. Passed post CTD.
sharps-island	Questionable or Suspect	11	Water Temperature	2024-06-03 12:40-0400	2024-06-03 14:40-0400	Failed CTD Cast	Failed pre CTD by 0.42C. Passed post CTD
sharps-island	BAD	Array		2024-06-03 13:40-0400	2024-06-03 14:45-0400	Maintenance	Cleaning
sharps-island	BAD	Array		2024-06-05 11:09-0400	2024-06-05 11:30-0400	Maintenance	Cleaning
sharps-island	BAD	11	Dissolved Oxygen	2024-06-18 09:20-0400	2024-06-20 10:40-0400	Read 0	No data
sharps-island	BAD	11	Dissolved Oxygen Adj	2024-06-18 09:20-0400	2024-06-20 10:40-0400	Read 0	No data
sharps-island	BAD	11	Dissolved Oxygen	2024-06-19 01:15-0400	2024-06-20 06:26-0400	Bad Sensor	
sharps-island	BAD	11	Dissolved Oxygen Adj	2024-06-19 01:15-0400	2024-06-20 06:26-0400	Bad Sensor	
sharps-island	BAD	Array		2024-06-20 10:26-0400	2024-06-20 11:34-0400	Maintenance	Cleaning
sharps-island	BAD	15	Conductivity	2024-06-20 11:43-0400	2024-07-08 01:00-0400	Bad data	Conductivity sensor was not functioning properly starting on 6/20. Failed pre and post CTD on 7/2. Conductivity readings were an outlier compared to other sensors. Returns to normal on 7/8.
sharps-island	BAD	15	Salinity	2024-06-20 11:43-0400	2024-07-08 01:00-0400	Bad data	Conductivity sensor was not functioning properly starting on 6/20. Failed pre and post CTD on 7/2. Conductivity readings were an outlier compared to other sensors. Returns to normal on 7/8.
sharps-island	BAD	13	Dissolved Oxygen	2024-06-28 04:20-0400	2024-06-29 01:30-0400	Bad data	Reading 0s
sharps-island	BAD	13	Dissolved Oxygen Adj	2024-06-28 04:20-0400	2024-06-29 01:30-0400	Bad data	Reading 0s
sharps-island	BAD	13	Dissolved Oxygen Adj	2024-07-01 08:00-0400	2024-07-02 09:40-0400	Read 0	No data
sharps-island	BAD	13	Dissolved Oxygen	2024-07-01 08:00-0400	2024-07-02 09:40-0400	Read 0	No data
sharps-island	Questionable or Suspect	15	Water Temperature	2024-07-02 08:45-0400	2024-07-02 09:45-0400	Bad data	Failed pre CTD on 7/2 by 3.5C. Passed post CTD on 7/2
sharps-island	BAD	Array		2024-07-02 09:45-0400	2024-07-02 11:13-0400	Maintenance	Cleaning
sharps-island	BAD	15	Salinity	2024-07-09 07:20-0400	2024-07-10 02:10-0400	Bad data	Extreme and rapid conductivity fluctuations that were abnormal when compared to other sensors.
sharps-island	BAD	15	Conductivity	2024-07-09 07:20-0400	2024-07-10 02:10-0400	Bad data	Extreme and rapid conductivity fluctuations that were abnormal when compared to other sensors.

sharps-island	BAD	15	Conductivity	2024-07-10 18:00-0400	2024-07-11 08:00-0400	Bad data	Extreme and rapid conductivity fluctuations that were abnormal when compared to other sensors.
sharps-island	BAD	15	Salinity	2024-07-10 18:00-0400	2024-07-11 08:00-0400	Bad data	Extreme and rapid conductivity fluctuations that were abnormal when compared to other sensors.
sharps-island	BAD	Array		2024-07-16 08:00-0400	2024-07-16 09:22-0400	Maintenance	Cleaning
sharps-island	Questionable or Suspect	11	Water Temperature	2024-07-16 09:29-0400	2024-07-16 10:29-0400	Failed CTD Cast	Failed post CTD by 0.26C. Passed pre CTD on same visit.
sharps-island	BAD	5	Salinity	2024-07-16 09:29-0400	2024-08-13 09:49-0400	Failed CTD Cast	Bad data
sharps-island	BAD	15	Conductivity	2024-07-16 09:29-0400	2024-08-13 09:49-0400	Failed CTD Cast	Bad data
sharps-island	BAD	15	Salinity	2024-07-16 09:29-0400	2024-08-13 09:49-0400	Failed CTD Cast	Bad data
sharps-island	BAD	Array		2024-08-05 09:33-0400	2024-08-13 09:38-0400	Maintenance	Cleaning
sharps-island	BAD	8	Dissolved Oxygen	2024-08-13 09:00-0400	2024-08-27 04:50-0400	Read 0	No data
sharps-island	BAD	8	Dissolved Oxygen Adj	2024-08-13 09:00-0400	2024-08-27 04:50-0400	Read 0	No data
sharps-island	BAD	Array		2024-08-27 09:08-0400	2024-08-27 10:10-0400	Maintenance	Cleaning
sharps-island	Questionable or Suspect	13	Water Temperature	2024-09-02 08:45-0400	2024-07-02 09:45-0400	Failed CTD Cast	Failed pre CTD by 1.38C. Passed post CTD
sharps-island	Questionable or Suspect	13	Water Temperature	2024-09-02 08:45-0400	2024-07-02 09:45-0400	Failed CTD Cast	Failed pre CTD by 1.38C. Passed post CTD
sharps-island	BAD	Array		2024-09-10 08:47-0400	2024-09-10 09:18-0400	Maintenance	Cleaning
sharps-island	BAD	11	Conductivity	2024-09-17 06:20-0400	2024-09-23 11:32-0400	Sensor starts to decline	Failed pre CTD on 9/23 by 5.11. Fails Post by 5.81.
sharps-island	BAD	11	Salinity	2024-09-17 06:20-0400	2024-09-23 11:32-0400	Sensor starts to decline	Failed pre CTD on 9/23 by 5.11. Fails Post by 5.81.
sharps-island	BAD	Array		2024-09-23 10:58-0400	2024-09-23 11:22-0400	Maintenance	Cleaning
sharps-island	BAD	11	Water Temperature	2024-09-23 11:32-0400	2024-10-08 12:25-0400	Failed CTD Cast	Bad data
sharps-island	BAD	11	Dissolved Oxygen	2024-09-23 11:32-0400	2024-10-08 12:25-0400	Failed CTD Cast	Bad data
sharps-island	BAD	11	Dissolved Oxygen Adj	2024-09-23 11:32-0400	2024-10-08 12:25-0400	Failed CTD Cast	Bad data
sharps-island	BAD	11	Conductivity	2024-09-23 11:32-0400	2024-10-08 12:25-0400	Failed CTD Cast	Bad data
sharps-island	BAD	11	Salinity	2024-09-23 11:32-0400	2024-10-08 12:25-0400	Failed CTD Cast	Bad data



sharps-island	Questionable or Suspect	13	Dissolved Oxygen	2024-10-05 10:00-0400	2024-10-08 12:30-0400	Suspect data	DO gradually decreases after 10/5, below DO of 15m sensor. Before maintenance it read 0.163 mg/L then jumps to 5.97 right after the buoy goes back in the water. This jump in DO was not seen in other sensors. No pre CTD data to determine bad, but it passes post CTD
sharps-island	Questionable or Suspect	13	Dissolved Oxygen Adj	2024-10-05 10:00-0400	2024-10-08 12:30-0400	Suspect data	DO gradually decreases after 10/5, below DO of 15m sensor. Before maintenance it read 0.163 mg/L then jumps to 5.97 right after the buoy goes back in the water. This jump in DO was not seen in other sensors. No pre CTD data to determine bad, but it passes post CTD
sharps-island	Questionable or Suspect	8	Dissolved Oxygen	2024-10-08 10:45-0400	2024-10-08 11:45-0400	Failed pre CTD	Failed pre CTD on 10/8 by 0.03 mg/L. Passed post CTD
sharps-island	Questionable or Suspect	8	Dissolved Oxygen Adj	2024-10-08 10:45-0400	2024-10-08 11:45-0400	Failed pre CTD	Failed pre CTD on 10/8 by 0.03 mg/L. Passed post CTD
sharps-island	BAD	Array		2024-10-08 11:45-0400	2024-10-08 12:12-0400	Maintenance	Cleaning
sharps-island	Questionable or Suspect	13	Dissolved Oxygen Adj	2024-10-29 08:21-0400	2024-10-29 09:21-0400	Suspect data	Failed pre CTD by .81mg/L. No post CTD, but sensor passes pre CTD on 11/14
sharps-island	Questionable or Suspect	13	Dissolved Oxygen	2024-10-29 08:21-0400	2024-10-29 09:21-0400	Suspect data	Failed pre CTD by .81mg/L. No post CTD, but sensor passes pre CTD on 11/14
sharps-island	BAD	Array		2024-10-29 09:21-0400	2024-10-29 10:01-0400	Maintenance	Cleaning
sharps-island	BAD	Array		2024-11-13 10:03-0500	2024-12-31 23:59-0500	End of 2024 season	Removed from water



Lower Potomac

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
lower-potomac	BAD	Array		2023-12-31 23:00-0500	2024-06-11 11:38-0400	Pre-deployment data	Ommit
lower-potomac	BAD	Array		2024-01-01 00:00-0500	2024-06-11 10:38-0400	Initial Deployment	
lower-potomac	BAD	Array		2024-06-25 12:15-0400	2024-06-25 12:40-0400	Maintenance	Cleaning
lower-potomac	Questionable or Suspect	2	Water Temperature	2024-06-25 12:52-0400	2024-07-09 10:55-0400	Suspect data	Passed on another date
lower-potomac	BAD	5	Conductivity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	5	Salinity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	8	Salinity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	8	Conductivity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	10	Conductivity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	10	Salinity	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Fails pre CTD cast and passes post. Biofouling in cell
lower-potomac	BAD	2	Dissolved Oxygen	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Failed Pre CTD by 1.54 mg/L, data becomes intermittent and starts to drift
lower-potomac	BAD	2	Dissolved Oxygen Adj	2024-07-06 06:40-0400	2024-07-09 10:00-0400	Bad Data	Failed Pre CTD by 1.54 mg/L, data becomes intermittent and starts to drift
lower-potomac	BAD	5	Dissolved Oxygen	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD data becomes intermittent and starts to drift
lower-potomac	BAD	5	Dissolved Oxygen Adj	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD data becomes intermittent and starts to drift
lower-potomac	BAD	8	Dissolved Oxygen	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD by 2.34 mg/L data becomes intermittent and starts to drift, excessive fouling
lower-potomac	BAD	8	Dissolved Oxygen Adj	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD by 2.34 mg/L data becomes intermittent and starts to drift, excessive fouling
lower-potomac	BAD	10	Dissolved Oxygen	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD by 2.67 mg/L data becomes intermittent and starts to drift, excessive fouling
lower-potomac	BAD	10	Dissolved Oxygen Adj	2024-07-06 06:40-0400	2024-07-09 10:10-0400	Bad Data	Failed Pre CTD by 2.67 mg/L data becomes intermittent and starts to drift, excessive fouling
lower-potomac	BAD	Array		2024-07-09 10:17-0400	2024-07-09 10:48-0400	Maintenance	Cleaning
lower-potomac	BAD	Array		2024-07-24 09:32-0400	2024-07-24 10:54-0400	Maintenance	Cleaning
lower-potomac	BAD	Array		2024-08-07 10:27-0400	2024-08-07 11:12-0400	Maintenance	Cleaning
lower-potomac	BAD	2	Dissolved Oxygen	2024-08-07 10:50-0400	2024-08-07 21:10-0400	Bad Data	Failed Post CTD slightly, due to what looks like the sensor being unsettled
lower-potomac	BAD	2	Dissolved Oxygen Adj	2024-08-07 10:50-0400	2024-08-07 21:10-0400	Bad Data	Failed Post CTD slightly, due to what looks like the sensor being unsettled
lower-potomac	BAD	8	Salinity	2024-08-07 11:25-0400	2024-08-20 14:57-0400	Failed CTD Cast	Bad data

lower-potomac	BAD	5	Dissolved Oxygen	2024-08-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 1.8 mg/L, also fails post by 0.39 mg/L. The post fail was likely due to the instrument not having enough time to equilibrate to water before CTD Cast
lower-potomac	BAD	5	Dissolved Oxygen Adj	2024-08-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 1.8 mg/L, also fails post by 0.39 mg/L. The post fail was likely due to the instrument not having enough time to equilibrate to water before CTD Cast
lower-potomac	BAD	8	Dissolved Oxygen	2024-08-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 2.14 mg/L and post by 1.62 mg/L. The data drops off from a normal trend likely do to excessive biofouling. Additionally the sensor post cleaning did not have enough time to equilibrate post redeployment, data settles out after more time
lower-potomac	BAD	8	Dissolved Oxygen Adj	2024-08-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 2.14 mg/L and post by 1.62 mg/L. The data drops off from a normal trend likely do to excessive biofouling. Additionally the sensor post cleaning did not have enough time to equilibrate post redeployment, data settles out after more time
lower-potomac	BAD	Array		2024-08-20 13:59-0400	2024-08-20 14:45-0400	Maintenance	Cleaning
lower-potomac	Questionable or Suspect	2	Conductivity	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	5	Dissolved Oxygen	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	5	Dissolved Oxygen Adj	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	8	Dissolved Oxygen Adj	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	8	Salinity	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	5	Salinity	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	8	Dissolved Oxygen	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	10	Dissolved Oxygen	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	10	Dissolved Oxygen Adj	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	10	Salinity	2024-08-20 14:57-0400	2024-09-05 13:57-0400	Suspect data	Passed on another date
lower-potomac	BAD	Array		2024-09-05 13:05-0400	2024-09-05 13:40-0400	Maintenance	Cleaning
lower-potomac	Questionable or Suspect	2	Dissolved Oxygen	2024-09-05 13:57-0400	2024-09-24 11:45-0400	Suspect data	Passed on another date
lower-potomac	Questionable or Suspect	2	Dissolved Oxygen Adj	2024-09-05 13:57-0400	2024-09-24 11:45-0400	Suspect data	Passed on another date
lower-potomac	BAD	5	Dissolved Oxygen	2024-09-22 22:20-0400	2024-09-24 12:10-0400	Bad Data	Fails pre CTD cast by 0.34, passes post cleaning ctd cast
lower-potomac	BAD	5	Dissolved Oxygen Adj	2024-09-22 22:20-0400	2024-09-24 12:10-0400	Bad Data	Fails pre CTD cast by 0.34, passes post cleaning ctd cast
lower-potomac	BAD	8	Dissolved Oxygen	2024-09-22 22:20-0400	2024-09-24 12:10-0400	Bad Data	Fails pre CTD cast by 0.45 mg/L. Aligning with other sensors
lower-potomac	BAD	8	Dissolved Oxygen Adj	2024-09-22 22:20-0400	2024-09-24 12:10-0400	Bad Data	Fails pre CTD cast by 0.45 mg/L. Aligning with other sensors
lower-potomac	BAD	Array		2024-09-24 10:53-0400	2024-09-24 11:38-0400	Maintenance	Cleaning

lower-potomac	BAD	8	Dissolved Oxygen	2024-10-03 07:40-0400	2024-10-03 09:55-0400	Failed CTD Cast	Fails pre CTD, data had started to drift
lower-potomac	BAD	8	Dissolved Oxygen Adj	2024-10-03 07:40-0400	2024-10-03 09:55-0400	Failed CTD Cast	Fails pre CTD, data had started to drift
lower-potomac	BAD	Array		2024-10-03 10:08-0400	2024-10-03 10:35-0400	Maintenance	Cleaning
lower-potomac	BAD	10	Dissolved Oxygen	2024-10-03 10:10-0400	2024-10-03 10:50-0400	Bad Data	Fails pre CTD cast by 0.17 mg/L, data had started to drift due to biofouling
lower-potomac	BAD	10	Dissolved Oxygen Adj	2024-10-03 10:10-0400	2024-10-03 10:50-0400	Bad Data	Fails pre CTD cast by 0.17 mg/L, data had started to drift due to biofouling
lower-potomac	Questionable or Suspect	2	Dissolved Oxygen	2024-10-03 10:40-0400	2024-10-03 19:00-0400	Failed CTD Cast	Fails post CTD by 0.05 mg/L, marking as suspect as the instrument likely didnt equilibrate
lower-potomac	Questionable or Suspect	2	Dissolved Oxygen Adj	2024-10-03 10:40-0400	2024-10-03 19:00-0400	Failed CTD Cast	Fails post CTD by 0.05 mg/L, marking as suspect as the instrument likely didnt equilibrate
lower-potomac	BAD	5	Dissolved Oxygen	2024-10-03 10:44-0400	2024-10-23 12:51-0400	Failed CTD Cast	Bad data
lower-potomac	BAD	5	Dissolved Oxygen Adj	2024-10-03 10:44-0400	2024-10-23 12:51-0400	Failed CTD Cast	Bad data
lower-potomac	BAD	10	Dissolved Oxygen	2024-10-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 1.54 mg/L and post by 1.64 mg/L. Data drops off due to biofouling and takes time to equilibrate after redeploying
lower-potomac	BAD	10	Dissolved Oxygen Adj	2024-10-18 22:30-0400	2024-08-20 18:00-0400	Bad Data	Fails pre CTD cast by 1.54 mg/L and post by 1.64 mg/L. Data drops off due to biofouling and takes time to equilibrate after redeploying
lower-potomac	BAD	2	Dissolved Oxygen	2024-10-23 10:40-0400	2024-10-23 20:30-0400	Failed CTD Cast	Fails post CTD by 0.18 mg/L, data had started to drift due to biofouling and need more time to equilibrate after deployment
lower-potomac	BAD	2	Dissolved Oxygen Adj	2024-10-23 10:40-0400	2024-10-23 20:30-0400	Failed CTD Cast	Fails post CTD by 0.18 mg/L, data had started to drift due to biofouling and need more time to equilibrate after deployment
lower-potomac	BAD	5	Dissolved Oxygen	2024-10-23 10:50-0400	2024-10-23 11:50-0400	Failed CTD Cast	Fails post CTD by 0.19 mg/L, data had need more time to equilibrate after deployment
lower-potomac	BAD	5	Dissolved Oxygen Adj	2024-10-23 10:50-0400	2024-10-23 11:50-0400	Failed CTD Cast	Fails post CTD by 0.19 mg/L, data had need more time to equilibrate after deployment
lower-potomac	BAD	Array		2024-10-23 12:05-0400	2024-10-23 12:39-0400	Maintenance	Cleaning
lower-potomac	BAD	Array		2024-11-07 10:35-0500	2024-11-07 11:02-0500	Maintenance	Cleaning
lower-potomac	BAD	Array		2024-11-26 05:50-0500	9999-12-31 18:50-0500	End of 2024 season	Buoy broke off mooring

Herring Creek

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
herring-creek	BAD	Array		2023-12-31 23:00-0500	2024-06-11 11:39-0400	Pre-deployment data	Ommit
herring-creek	BAD	Array		2023-12-31 23:00-0500	2024-06-11 07:39-0400	Initial Deployment	
herring-creek	BAD	Array		2024-06-25 10:21-0400	2024-06-25 11:24-0400	Maintenance	Cleaning
herring-creek	BAD	14	Dissolved Oxygen Adj	2024-07-07 13:00-0400	2024-07-20 14:40-0400	Read 0	No data
herring-creek	BAD	14	Dissolved Oxygen	2024-07-07 13:00-0400	2024-07-20 14:40-0400	Read 0	No data
herring-creek	BAD	5	Dissolved Oxygen Adj	2024-07-08 09:40-0400	2024-07-09 11:30-0400	Bad Data	Fails Pre CTD by 1.19 mg/L, data becomes erratic, excessive biofouling
herring-creek	BAD	5	Dissolved Oxygen	2024-07-08 09:40-0400	2024-07-09 11:30-0400	Bad Data	Fails Pre CTD by 1.19 mg/L, data becomes erratic, excessive biofouling
herring-creek	BAD	Array		2024-07-09 11:53-0400	2024-07-09 12:26-0400	Maintenance	Cleaning
herring-creek	Questionable or Suspect	11	Water Temperature	2024-07-24 09:40-0400	2024-07-24 11:40-0400	Failed CTD Cast	Sensor failed pre CTD cast by 0.31 C. Sensor passes post CTD.
herring-creek	BAD	5	Dissolved Oxygen	2024-07-24 11:40-0400	2024-07-24 14:20-0400	Bad Data	Failed Pre CTD by 0.89 mg/L, due to biofouling
herring-creek	BAD	5	Dissolved Oxygen Adj	2024-07-24 11:40-0400	2024-07-24 14:20-0400	Bad Data	Failed Pre CTD by 0.89 mg/L, due to biofouling
herring-creek	BAD	Array		2024-07-24 11:40-0400	2024-07-24 12:43-0400	Maintenance	Cleaning
herring-creek	Questionable or Suspect	11	Dissolved Oxygen	2024-07-31 07:19-0400	2024-08-07 20:20-0400	Data comes close to flatline	Fails pre ctd by 1.88mg/L, data does not flatline to zero, has small flux. Challenging call
herring-creek	Questionable or Suspect	11	Dissolved Oxygen Adj	2024-07-31 07:19-0400	2024-08-07 20:20-0400	Data comes close to flatline	Fails pre ctd by 1.88mg/L, data does not flatline to zero, has small flux. Challenging call
herring-creek	BAD	8	Dissolved Oxygen	2024-07-31 08:40-0400	2024-08-07 09:40-0400	Bad Data	Fails a pre cleaning CTD by 4.72 mg/L while post cleaning the data jumps to passing values
herring-creek	BAD	8	Dissolved Oxygen Adj	2024-07-31 08:40-0400	2024-08-07 09:40-0400	Bad Data	Fails a pre cleaning CTD by 4.72 mg/L while post cleaning the data jumps to passing values
herring-creek	BAD	5	Dissolved Oxygen	2024-08-02 11:20-0400	2024-08-07 16:10-0400	Bad Data	Failed Pre CTD by 2.91 mg/L, due to biofouling
herring-creek	BAD	5	Dissolved Oxygen Adj	2024-08-02 11:20-0400	2024-08-07 16:10-0400	Bad Data	Failed Pre CTD by 2.91 mg/L, due to biofouling
herring-creek	BAD	2	Dissolved Oxygen	2024-08-06 20:40-0400	2024-08-20 11:10-0400	Bad Data	Sensor failed, dropped to zero
herring-creek	BAD	2	Dissolved Oxygen Adj	2024-08-06 20:40-0400	2024-08-20 11:10-0400	Bad Data	Sensor failed, dropped to zero
herring-creek	BAD	14	Dissolved Oxygen	2024-08-07 02:00-0400	2024-10-03 13:00-0400	Bad Data	Broken Sensor
herring-creek	BAD	14	Dissolved Oxygen Adj	2024-08-07 02:00-0400	2024-10-03 13:00-0400	Bad Data	Broken Sensor
herring-creek	BAD	2	Dissolved Oxygen	2024-08-07 08:40-0400	2024-08-20 15:40-0400	Bad DO Sensor	Broken
herring-creek	BAD	2	Dissolved Oxygen Adj	2024-08-07 08:40-0400	2024-08-20 15:40-0400	Bad DO Sensor	Broken
herring-creek	BAD	Array		2024-08-07 12:07-0400	2024-08-07 12:50-0400	Maintenance	Cleaning
herring-creek	BAD	5	Dissolved Oxygen	2024-08-20 09:00-0400	2024-08-20 11:00-0400	Bad Data	Failed Pre CTD by 1.43 mg/L, from looking at the pressure sensor the CTD might have been done to close to the buoy being pulled

herring-creek	BAD	5	Dissolved Oxygen Adj	2024-08-20 09:00-0400	2024-08-20 11:00-0400	Bad Data	Failed Pre CTD by 1.43 mg/L, from looking at the pressure sensor the CTD might have been done to close to the buoy being pulled
herring-creek	BAD	Array		2024-08-20 11:35-0400	2024-08-20 12:56-0400	Maintenance	Cleaning
herring-creek	BAD	5	Dissolved Oxygen	2024-09-05 09:00-0400	2024-09-05 12:00-0400	Bad Data	Failed Pre CTD by 0.05 mg/L and post ctd by 0.77mg/L, from looking at the pressure sensor the CTD might have been done to close to the buoy being pulled
herring-creek	BAD	5	Dissolved Oxygen Adj	2024-09-05 09:00-0400	2024-09-05 12:00-0400	Bad Data	Failed Pre CTD by 0.05 mg/L and post ctd by 0.77mg/L, from looking at the pressure sensor the CTD might have been done to close to the buoy being pulled
herring-creek	BAD	Array		2024-09-05 11:30-0400	2024-09-05 12:00-0400	Maintenance	Cleaning
herring-creek	BAD	11	Salinity	2024-09-15 13:00-0400	2024-09-24 12:40-0400	Failed CTD Cast	Sensor failed pre CTD cast on 9/24 by 9.161. Data looks abnormal compared to nearby sensors starting on 9/15.
herring-creek	BAD	5	Dissolved Oxygen Adj	2024-09-16 01:30-0400	2024-09-24 09:24-0400	Bad Data	Sensor started to fail and flatline
herring-creek	BAD	5	Dissolved Oxygen	2024-09-16 01:30-0400	2024-09-24 09:24-0400	Bad Data	Sensor started to fail and flatline
herring-creek	Questionable or Suspect	2	Salinity	2024-09-22 06:00-0400	2024-09-24 12:40-0400	Failed CTD Cast	Sensor failed pre CTD cast by 5.486. Sensor passes post CTD.
herring-creek	Questionable or Suspect	14	Salinity	2024-09-24 11:00-0400	2024-09-24 12:40-0400	Failed CTD Cast	Sensor failed pre CTD cast by 7.757. Sensor passes post CTD.
herring-creek	BAD	Array		2024-09-24 12:40-0400	2024-09-24 13:30-0400	Maintenance	Cleaning
herring-creek	Questionable or Suspect	11	Salinity	2024-09-24 13:30-0400	2024-09-26 16:00-0400	Failed CTD Cast	Sensor failed post CTD cast on 9/24 by 6.84. Difficult to determine exact suspect timeframe.
herring-creek	Questionable or Suspect	11	Dissolved Oxygen	2024-10-03 11:00-0400	2024-10-03 17:00-0400	Not enough time to equilibrate	Fails post CTD by 1.12mg/L but quickly normalizes after
herring-creek	Questionable or Suspect	11	Dissolved Oxygen Adj	2024-10-03 11:00-0400	2024-10-03 17:00-0400	Not enough time to equilibrate	Fails post CTD by 1.12mg/L but quickly normalizes after
herring-creek	BAD	Array		2024-10-03 11:29-0400	2024-10-03 11:55-0400	Maintenance	Cleaning
herring-creek	BAD	Array		2024-10-11 12:30-0400	2024-11-07 09:30-0500	Breakaway	Buoy was not operational during this time, so data is invalid. This is due to a cable breakaway. Line was recovered on 10/23, and a new array was deployed on 11/7.
herring-creek	BAD	Array		2024-10-13 10:03-0400	2024-10-13 11:03-0400	Maintenance	Cleaning
herring-creek	BAD	Array		2024-12-17 09:00-0500	2024-12-31 23:59-0500	End of 2024 season	Removed from water

Clements Island

Station	QC	Depth	Measurement	Start Time (EDT)	End Time (EDT)	Reason	Notes
clements-island	BAD	Array		2023-12-31 23:00-0500	2024-06-11 08:29-0400	Initial Deployment	
clements-island	BAD	Array		2023-12-31 23:00-0500	2024-06-11 12:29-0400	Pre-deployment data	Omit
clements-island	BAD	Array		2024-06-25 13:43-0400	2024-06-25 14:28-0400	Maintenance	Cleaning
clements-island	BAD	5	Dissolved Oxygen	2024-06-25 14:43-0400	2024-07-24 14:17-0400	Failed CTD Cast	Bad data
clements-island	BAD	5	Dissolved Oxygen Adj	2024-06-25 14:43-0400	2024-07-24 14:17-0400	Failed CTD Cast	Bad data
clements-island	BAD	5	Water Temperature	2024-06-25 15:43-0400	2024-06-28 20:40-0400	CTD pre and post roughly -1.0 difference	Passes before cleaning on 7/9
clements-island	BAD	2	Dissolved Oxygen	2024-07-09 05:10-0400	2024-07-09 16:20-0400	Bad Data	Sensor failed Pre CTD by 0.70 mg/L while post failed 0.28 mg/L. Looks to be due to biofouling and recovering / deploying sensors to close to CTD cast
clements-island	BAD	2	Dissolved Oxygen Adj	2024-07-09 05:10-0400	2024-07-09 16:20-0400	Bad Data	Sensor failed Pre CTD by 0.70 mg/L while post failed 0.28 mg/L. Looks to be due to biofouling and recovering / deploying sensors to close to CTD cast
clements-island	BAD	Array		2024-07-09 13:05-0400	2024-07-09 13:50-0400	Maintenance	Cleaning
clements-island	Questionable or Suspect	5	Water Temperature	2024-07-09 14:05-0400	2024-07-24 14:17-0400	Suspect data	Passed on another date
clements-island	BAD	5	Dissolved Oxygen	2024-07-09 14:05-0400	2024-07-24 14:17-0400	Failed CTD Cast	Bad data
clements-island	BAD	5	Dissolved Oxygen Adj	2024-07-09 14:05-0400	2024-07-24 14:17-0400	Failed CTD Cast	Bad data
clements-island	BAD	2	Dissolved Oxygen	2024-07-21 22:21-0400	2024-07-24 15:30-0400	Bad Data	Sensor failed Pre CTD by 4.8 mg/L, excessive biofouling
clements-island	BAD	2	Dissolved Oxygen Adj	2024-07-21 22:21-0400	2024-07-24 15:30-0400	Bad Data	Sensor failed Pre CTD by 4.8 mg/L, excessive biofouling
clements-island	BAD	8	Dissolved Oxygen	2024-07-24 01:10-0400	2024-07-24 13:10-0400	Bad Data	Fails pre ctd by 0.89 mg/L, some biofouling
clements-island	BAD	8	Dissolved Oxygen Adj	2024-07-24 01:10-0400	2024-07-24 13:10-0400	Bad Data	Fails pre ctd by 0.89 mg/L, some biofouling
clements-island	BAD	Array		2024-07-24 13:40-0400	2024-07-24 14:05-0400	Maintenance	Cleaning
clements-island	BAD	Array		2024-07-25 17:30-0400	2024-08-08 12:00-0400	Data Gap	No comms
clements-island	BAD	5	Dissolved Oxygen	2024-08-02 11:20-0400	2024-08-07 16:10-0400	Bad Data	Sensor failed Pre CTD by 2.91 mg/L, had extensive biofouling
clements-island	BAD	5	Dissolved Oxygen Adj	2024-08-02 11:20-0400	2024-08-07 16:10-0400	Bad Data	Sensor failed Pre CTD by 2.91 mg/L, had extensive biofouling
clements-island	BAD	Array		2024-08-07 14:30-0400	2024-08-07 15:34-0400	Maintenance	Cleaning
clements-island	BAD	11	Dissolved Oxygen	2024-08-20 02:30-0400	2024-08-20 10:40-0400	Bad Data	Sensor failed Pre CTD by 1.85mg/L, looks like the cast could have been done to close to recovering the station
clements-island	BAD	11	Dissolved Oxygen Adj	2024-08-20 02:30-0400	2024-08-20 10:40-0400	Bad Data	Sensor failed Pre CTD by 1.85mg/L, looks like the cast could have been done to close to recovering the station
clements-island	BAD	8	Dissolved Oxygen	2024-08-20 06:00-0400	2024-08-20 11:40-0400	Bad Data	Failed Pre CTD by 1.43 mg/L. Data could have failed due to biofouling and doing the cast to close to the recovery
clements-island	BAD	8	Dissolved Oxygen Adj	2024-08-20 06:00-0400	2024-08-20 11:40-0400	Bad Data	Failed Pre CTD by 1.43 mg/L. Data could have failed due to biofouling and doing the cast to close to the recovery
clements-island	Questionable or Suspect	5	Dissolved Oxygen	2024-08-20 09:00-0400	2024-08-20 11:00-0400	Bad Data	Sensor failed Pre CTD by 1.43 mg/L. From reviewing the pressure data the cast might have been done to close to recovering the buoy
clements-island	Questionable or Suspect	5	Dissolved Oxygen Adj	2024-08-20 09:00-0400	2024-08-20 11:00-0400	Bad Data	Sensor failed Pre CTD by 1.43 mg/L. From reviewing the pressure data the cast might have been done to close to recovering the buoy
clements-island	Questionable or Suspect	2	Salinity	2024-08-20 09:14-0400	2024-09-05 10:35-0400	Suspect data	Passed on another date
clements-island	BAD	5	Salinity	2024-08-20 09:14-0400	2024-09-24 15:42-0400	Failed CTD Cast	Bad data
clements-island	BAD	Array		2024-08-20 09:45-0400	2024-08-20 10:30-0400	Maintenance	Cleaning
clements-island	BAD	14	Dissolved Oxygen	2024-09-04 04:30-0400	2024-09-05 09:30-0400	Bad Data	Failed Pre CTD cast by 0.46mg/L, biofouling caused a slight drift
clements-island	BAD	14	Dissolved Oxygen Adj	2024-09-04 04:30-0400	2024-09-05 09:30-0400	Bad Data	Failed Pre CTD cast by 0.46mg/L, biofouling caused a slight drift
clements-island	BAD	5	Dissolved Oxygen	2024-09-05 09:00-0400	2024-09-05 12:00-0400	Bad Data	Failed Pre CTD by 0.05 mg/L and Post by 0.77 mg/L. Some biofouling and taking CTD to close to recovery / deployment
clements-island	BAD	5	Dissolved Oxygen Adj	2024-09-05 09:00-0400	2024-09-05 12:00-0400	Bad Data	Failed Pre CTD by 0.05 mg/L and Post by 0.77 mg/L. Some biofouling and taking CTD to close to recovery / deployment
clements-island	BAD	8	Dissolved Oxygen	2024-09-05 09:20-0400	2024-09-05 11:00-0400	Bad Data	Fails Pre CTD by 0.05mg/L and Post 1.21mg/L. Data looks to be unsettled due to recovering / deploying sensors.
clements-island	BAD	8	Dissolved Oxygen Adj	2024-09-05 09:20-0400	2024-09-05 11:00-0400	Bad Data	Fails Pre CTD by 0.05mg/L and Post 1.21mg/L. Data looks to be unsettled due to recovering / deploying sensors.
clements-island	BAD	Array		2024-09-05 09:39-0400	2024-09-05 10:28-0400	Maintenance	Cleaning
clements-island	BAD	2	Salinity	2024-09-05 11:35-0400	2024-12-17 09:00-0500	Inconsistent Readings, Sudden Drops	Bad CTD Readings
clements-island	BAD	11	Conductivity	2024-09-05 19:00-0400	2024-09-24 16:40-0400	No Comms	No data
clements-island	BAD	11	Salinity	2024-09-05 19:00-0400	2024-09-24 16:40-0400	No Comms	No data
clements-island	BAD	11	Water Temperature	2024-09-05 19:00-0400	2024-09-24 16:40-0400	No Comms	No data
clements-island	BAD	14	Dissolved Oxygen	2024-09-08 20:00-0400	2024-09-24 15:00-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	14	Dissolved Oxygen Adj	2024-09-08 20:00-0400	2024-09-24 15:00-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	8	Dissolved Oxygen	2024-09-15 01:10-0400	2024-09-24 15:50-0400	Bad Data	Fails pre ctd by 5.66 mg/L, sensor had started to decay and flatlined
clements-island	BAD	8	Dissolved Oxygen Adj	2024-09-15 01:10-0400	2024-09-24 15:50-0400	Bad Data	Fails pre ctd by 5.66 mg/L, sensor had started to decay and flatlined
clements-island	BAD	5	Dissolved Oxygen	2024-09-16 01:30-0400	2024-09-24 15:40-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	5	Dissolved Oxygen Adj	2024-09-16 01:30-0400	2024-09-24 15:40-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	5	Dissolved Oxygen	2024-09-24 12:40-0400	2024-09-24 14:19-0400	Bad Data	Sensor failed Pre CTD by 0.89 mg/L, biofouling was extensive
clements-island	BAD	5	Dissolved Oxygen Adj	2024-09-24 12:40-0400	2024-09-24 14:19-0400	Bad Data	Sensor failed Pre CTD by 0.89 mg/L, biofouling was extensive
clements-island	BAD	Array		2024-09-24 14:45-0400	2024-09-24 15:22-0400	Maintenance	Cleaning
clements-island	BAD	2	Salinity	2024-09-24 15:42-0400	2024-10-03 13:35-0400	Failed CTD Cast	Bad data

clements-island	BAD	14	Salinity	2024-09-24 15:45-0400	2024-12-17 12:30-0500	Inconsistent Readings, Sudden Drops	High CTD difference readings from 9 to 12 range
clements-island	BAD	8	Dissolved Oxygen	2024-09-29 15:10-0400	2024-10-23 15:00-0400	Bad Data	Fails pre ctd by 5.35 mg/L, data had flat lined
clements-island	BAD	8	Dissolved Oxygen Adj	2024-09-29 15:10-0400	2024-10-23 15:00-0400	Bad Data	Fails pre ctd by 5.35 mg/L, data had flat lined
clements-island	BAD	Array		2024-10-03 12:50-0400	2024-10-03 13:25-0400	Maintenance	Cleaning
clements-island	BAD	14	Dissolved Oxygen	2024-10-06 01:10-0400	2024-10-23 16:40-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	14	Dissolved Oxygen Adj	2024-10-06 01:10-0400	2024-10-23 16:40-0400	Bad Data	Sensor started to fail and flatline
clements-island	BAD	5	Dissolved Oxygen	2024-10-08 03:50-0400	2024-10-23 16:20-0400	Bad Data	Biofouling
clements-island	BAD	5	Dissolved Oxygen Adj	2024-10-08 03:50-0400	2024-10-23 16:20-0400	Bad Data	Biofouling
clements-island	BAD	2	Dissolved Oxygen	2024-10-12 05:20-0400	2024-10-23 16:20-0400	Bad Data	Biofouling
clements-island	BAD	2	Dissolved Oxygen Adj	2024-10-12 05:20-0400	2024-10-23 16:20-0400	Bad Data	Biofouling
clements-island	BAD	Array		2024-10-23 13:45-0400	2024-10-23 14:36-0400	Maintenance	Cleaning
clements-island	BAD	Array		2024-11-07 12:50-0500	2024-11-07 13:22-0500	Maintenance	Cleaning
clements-island	BAD	Array		2024-12-17 09:00-0500	2024-12-31 23:59-0500	End of 2024 season	Removed from water

## Citations

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